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FIELD MANUAL

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ARMY RAIL TRANSPORT OPERATIONS AND UNITS

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HEADQUARTERS DEPARTMENT OF THE ARMY

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No. 55-20

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 14 June 1974

ARMY RAIL TRANSPORT OPERATIONS AND UNITS

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CHAPTER 1

INTRODUCTION

1-1. Purpose

This manual provides a general reference for military personnel of the transportation railway service (TRS) in a theater of operations. It also provides basic information for commanders and staffs of supporting units and for staff officers of higher headquarters. It is intended to serve as a textbook for the instruction of students and the training of unit personnel in railway operations, based on the administrative support, theater army (TASTA-70) doctrinal concepts

1-2. Scope

a. This manual discusses principles and procedures of train operations on a typical military railway division of 90 to 150 miles (approximately 145 to 241 kilometers). It must be considered as a guide only since equipment, terrain, weather, and operating conditions vary widely in different parts of the world. References are made to publications which describe organizations and procedures in detail.

b. International agreements (STANAG, SEASTAG, SOLOG, OSTAG, etc.) that apply to rail transportation services in a theater of operations are discussed in paragraph 1-4.

c. This manual is applicable to—

(1) General war, to include consideration of employment of and protection from nuclear and chemical weapons and protection from enemy use of biological agents or weapons.

(2) Limited war.

(3) Cold war, to include stability operations.

1-3. Recommended Changes

Users of this publication are encouraged to recommend changes and submit comments for its improvement. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons will be provided for each comment to insure understanding and complete evaluation. Comments

should be prepared using DA Form 2028 (Recommended Changes to Publications) and forwarded direct to the Commandant, US Army Transportation School (ATTN: ATSP-CTD-DT), Fort Eustis, Virginia 23604. Originators of proposed changes or additions to the manual that may constitute a significant modification of approved Army doctrine may send an information copy through command channels to the Commander, US Army Training and Doctrine Command, Fort Monroe, Virginia 23651, to facilitate review and followup.

1-4. International Standardization Agreements

This manual is in consonance with certain international standardization agreements which are identified by type and agreement identification number at the beginning of each appropriate chapter in the manual.

a. DA Pamphlet 310-35, Index of International Standardization Agreements, lists all standardization agreements, both of a materiel and a nonmateriel nature, binding upon the United States. The several types of nonmateriel agreements applicable to military operations which may affect rail transport operations are as follows:

(1) *STANAG (STANdardization AGreement)*: Applicable to the nations of the North Atlantic Treaty Organization (NATO).

(2) *CENTO STANAG (STANdardization AGreement)*: Applicable to nations of the Central Treaty Organization (CENTO).

(3) *SEASTAG (South East Asia STandardization AGreement)*: Applicable to nations of the South East Asia Treaty Organization (SEATO).

(4) *SOLOG (Standardization of Operations and LOGistics)*: A nonmateriel agreement among the armies of the United States, the United Kingdom, Canada, and Australia (the ABCA nations). The term SOLOG now applies only to those nonmateriel agreements which were ratified and published before 20 September 1967 (see QSTAG, (5) below).

(5) *QSTAG (Quadripartite Standardization Agreement)*: Materiel and nonmateriel agreements among the armies of the ABCA nations. The term QSTAG was adopted on 20 September 1967 and applies to all ABCA agreements (formerly designated as SOLOG) ratified and published subsequent to that date (see SOL-OG, (4) above).

b. US military operations are governed by these various agreements when US forces are employed within the geographical areas over which treaty organizations exercise jurisdiction; thus while operating in a European country which is a member of NATO, US forces comply with the provisions of applicable STANAG (a(1) above).

c. In a number of instances the provisions of certain agreements have been accepted as doctrine by the United States and incorporated into appropriate training and field manuals. A prime example of this is the use of the metric system to indicate distances. This accepted and published doctrine then becomes applicable to Armywide operations.

d. Although standardization agreements do not apply to military operations in the continental United States (CONUS), those which may concern a unit—in this case, those with a rail transport impact—must be considered in training and operational phases to permit military personnel to become acquainted with their provisions. This is particularly true for units or groups of personnel earmarked for oversea assignment.

e. To minimize operational differences in the various types of standardization agreements of the several treaty organizations, it is practice for one organization to accept and publish under its auspices an agreement that has been ratified and published by another treaty organization. For instance, all or any part of a STANAG may be adopted by the SEATO organization and be incorporated into and published as a SEASTAG. When this occurs, each organization uses the same agreement identification number wherever feasible (DA Pam 310-35).

f. Standardization agreements which are applicable to this manual are as follows:

<i>Title</i>	<i>NATO STANAG</i>	<i>CENTO STANAG</i>	<i>SEATO SEASTAG</i>
Rear Area Security and Rear Area Damage Control	2079 (2nd Ed)	2079 (2nd Ed)	2079
Destruction of Military Technical Equipment	2113		2113
Parallel Marking of Special Flat Wagons and Heavy Military Vehicles and Military Vehicles Using or Able to Use the P.P.I. Gauge	2153	2153	
Transport Request and Reply to Transport Request	2156	2156	
Identification of Military Trains	2158 (2nd Ed)	2158	
Forecast Movement Requirements, Rail, Road and Inland Waterways	2165		
Procedures for Military Trains Crossing Frontiers	2171		
Classification and Marking of Ordinary Flat Wagons Used for the Transport of Military Vehicles	2172		
Classification of Restrictions Affecting the Movement of Certain Military Equipment by Land on Continental Western Europe	2805-E, Annex B		

g. In the ratification of international agreements, a part or parts of an agreement may be nonacceptable to one or more of the participating nations. If so, a nation may accept the general terms of the agreement, reserving ratification of the particular part(s) with which it does not agree and with which it will not conform. This reservation action is noted in the allied documents to the agreement and becomes a matter of the agreement record. Any agreement applicable to this text to which the United States takes re-

servation is appropriately marked (w/reservation) and the text of the reservation is appended as an annex to the details of agreement as contained in this manual.

1-5. Transportation Railway Service in a Theater of Operations

a. The railway service is the overall organization of railway units assigned or attached to the senior transportation organization—normally a

transportation command, theater army support command (TASCOM). It is composed of railway supervisory, operating, and maintenance units as required to operate trains, to maintain rail lines of communication, and to perform organizational and direct support maintenance of locomotives and rolling stock. TRS supervisory units are so constituted that, depending upon the extent of the operation, any one of them may perform the staff and planning functions of, and serve as, the highest echelon of the military railway service in a theater. The highest echelon of the TRS in the theater is responsible for the reconnaissance of captured and liberated rail lines as early as practicable. The actual reconnaissance normally is performed by selected personnel from the headquarters and headquarters company, transportation railway battalion, augmented by personnel from higher rail units and the engineer command as required. The reconnaissance should produce the information required for planning. The railway battalion commander assigned the mission of operating a given section of rail line performs the necessary reconnaissance. He then determines the operating capabilities of the line in terms of net tonnage that may be handled, considering the characteristics of the line and the equipment and facilities actually available. Railway service normally is an intersectional service and may operate throughout the theater. In the event that an electric railway line is used, an electric power transmission unit maintains and repairs transmission facilities. General support maintenance of locomotives and rolling stock is performed by the transportation diesel-electric locomotive repair company and the transportation railway car repair company, both of which are assigned to the materiel command of the TASCOM.

b. The operation of military railways may be accomplished in three phases:

(1) *Phase I operation.* The phase I operation is conducted exclusively by military personnel. This phase normally is employed during (a) the early stages of a military operation when employment of civilian rail personnel is not practical and (b) in or near the combat zone of a theater where restrictions on the employment of civilians and when military need and security require that railway operations be conducted by railway troops under a unified command.

(2) *Phase II operation.* During this phase, railway lines are operated and maintained by military railway personnel augmented with local

civilian railway personnel under direct military supervision.

(3) *Phase III operation.* To provide for the release of military railway personnel, phase III operation is instituted as soon as practical. Under this arrangement, local civilian railway personnel operate and maintain railway lines under the direction and supervision of the highest military railway echelon in the theater. When practical, this phase is instituted in the rear areas of a stable and secure communications zone.

c. Although these phases normally progress in sequence, this does not preclude the inauguration of a phase II or III operation without progression through the preceding phases; nor does it preclude a similar regression of phases to meet military demands. The ultimate aim is to reduce requirements for military personnel and units to operate the railways. Since the phase III operation fulfills this aim and provides for the most economical employment of military units and personnel, it is, when it meets the military requirement, the most desirable phase of operation; every effort is made to inaugurate this operational phase as quickly as possible. Civil affairs organizations provide coordination between the Army and the host country personnel (FM 41-10).

d. A prime consideration in establishment of phase II and III operations is the availability of skilled local labor which may be provided through civil affairs organizations or, if available, through the civil railroad operator.

e. During stability operations, the rail net normally will be operated by host country personnel with a minimum number of US military advisers for supervision if requested by the host country (FM 31-23).

1-6. Organization of the Transportation Railway Service

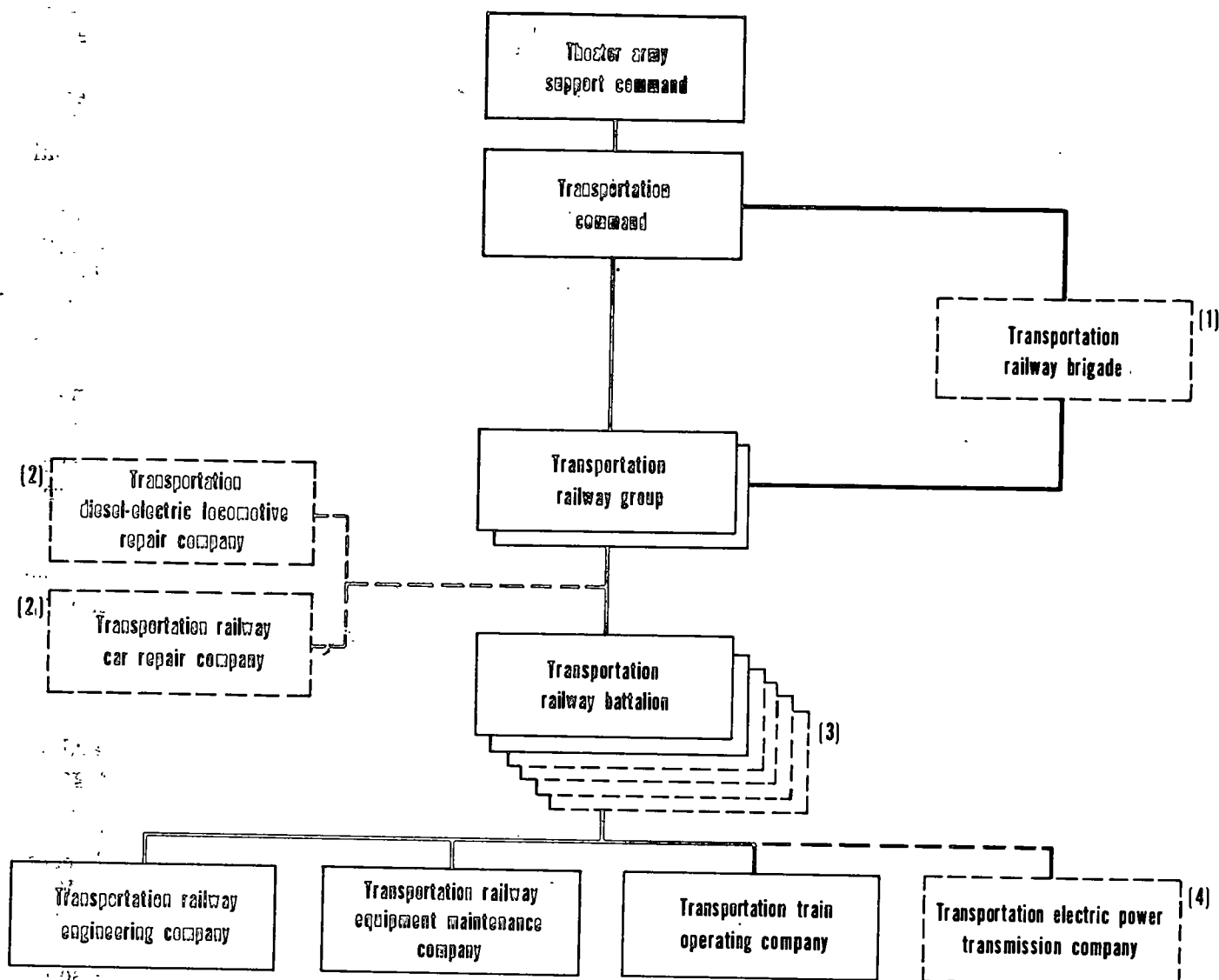
a. The TRS consists of the following command, supervisory, operating, and maintenance units, which are illustrated in figure 1-1 and discussed in chapter 2.

(1) *Supervisory and command.*

(a) Headquarters and headquarters company, transportation railway brigade.

(b) Headquarters and headquarters company, transportation railway group.

(c) Headquarters and headquarters company, transportation railway battalion.



Notes:

1. The brigade is interposed in this organization above group if three or more groups are assigned to theater army support command.
2. May be attached from the Materiel Command. (MATCOM)
3. Number of battalions (two to six per group) is dependent upon the scope of the railway operation.
4. When required for electrified operations.

Figure 1-1. Type transportation railway service organization.

(2) Operating and maintenance.

(a) Transportation railway engineering company.

(b) Transportation railway equipment maintenance company.

(c) Transportation railway train operating company.

(d) Transportation electric power transmission company.

b. TRS teams (para 2-12 and 2-13) organized

under table of organization and equipment (TOE) 55-520 may be attached to the TRS to provide additional support as required and as approved by the transportation command, TASCOT.

c. Two general support maintenance units that provide maintenance support on locomotives and rolling stock of the railway service—the transportation railway diesel-electric locomotive repair company and the transportation railway car repair company—are assigned to, and operate under supervision and control of, the materiel command (MATCOM), TASCOT, and the appropriate field depot. In view of the “single user” nature of the support provided by these two general support (GS) units, they may be attached to the TRS—usually through the transportation railway group headquarters, or similar TRS organization, which they support. In such cases, the day-to-day mission operations of these two GS units is influenced, to a limited degree, by the supported railway group headquarters. However, the parent MATCOM field depot will normally retain general operational control in coordination with the supported railway group headquarters.

(1) The influence exerted by the supported railway group headquarters involves such actions as—

(a) Determination of support requirements.

(b) Establishment of support priorities for the various railway units subordinate to the railway group concerned.

(c) Coordination of maintenance support actions between the individual railway operating unit(s) and the appropriate GS railway equipment maintenance unit.

(2) The two GS units will normally receive the following types of operational guidance from their parent MATCOM field depot:

(a) Maintenance policies and procedures which include the TASCOT and/or MATCOM interpretation of Department of the Army maintenance policies and procedures.

(b) Technical guidance pertaining to railway equipment repair parts supply support, which includes parts supply stock levels, etc.

(c) Requirements and procedures for preparation and submission of pertinent records and reports.

(d) Necessary directives pertaining to various operational and administrative matters.

d. The military police brigade provides security required beyond the capability of attached military police. Depending upon the tactical and guerrilla situation, combat troop support may be required for protection of rail lines of communication. This support is requested through channels by the railway service as required.

1-7. Classification of Military Railways

Railways are classified by gage as standard (56 1/2 inches or 143.5 centimeters), broad gage (60 inches or 152.4 centimeters, 63 inches or 160 centimeters, 66 inches or 167.6 centimeters), and meter (narrow) gage (42 inches or 106.7 centimeters, 39 3/8 inches or 100 centimeters). When there is a choice of gages to be used, the gage most predominant in the area should be used. In the absence of a rail net in the area, the source and availability of various types of equipment should be considered prior to selecting a gage for construction.



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CHAPTER 2

TRANSPORTATION RAILWAY UNITS

(STANAG 2113)

Section I. GENERAL

2-1. Introduction

a. The transportation railway service (TRS) of the theater army support command (TASCOM) consists of units required to supervise, operate, and maintain the existing railway net. Railway units are no longer organic battalions but are organized on the building block principle, which permits assignment to a theater of only those units required to operate and maintain the railway net.

b. Since all supervisory and subordinate railway units in a theater are assigned to the senior transportation organization (normally a transportation command), they operate under the command and supervision of that headquarters. Subordinate transportation railway units are attached further to a railway unit at the appropriate level of command for operation and control.

c. Coordination and supervision of up to two transportation railway groups are provided by the transportation command. When the rail net must be expanded to support larger forces, the headquarters and headquarters company, transportation railway brigade, will be interposed in the organizational structure between the groups and the transportation command as a supervisory and command headquarters (fig 1-1). The TRS organization permits the assignment of only those units which are required to support a limited military operation.

d. Each transportation railway supervisory and command unit is capable of supervising and operating a railway service within the stated capability of the unit. This provides flexibility in organizing a TRS since theater requirements may be met by an organization ranging from that requiring a brigade headquarters, as the senior railway unit, down to a limited operation in which a headquarters and headquarters company,

transportation railway battalion, would operate a system of 90-150 track miles (145-241 kilometers).

2-2. Command and Control

Command and operational control over the entire TRS, including all railway facilities buildings, real estate, and facilities, is exercised by the senior transportation organization (normally a transportation command), TASCOM, regardless of the extension of this service through other commands or territorial jurisdictions in the communications or combat zones. Commanders of area support commands or areas within the combat zone influence rail operations by coordination through command and technical channels as required.

2-3. Employment

a. The transportation railway units constituting the TRS operate the main rail systems in a theater of operations. Included in each system are the main line and the yards, sidings, and spur tracks required to connect the various installations to that line.

b. The transportation railway groups are assigned to and operate directly under the senior transportation organization (normally a transportation command), TASCOM. Each group administers and supervises the operation of one main rail route up to 900 miles (1,448 kilometers) long. The groups report directly to the railway brigade or the transportation command, which coordinates the efforts of the groups in accomplishing the theater rail mission.

c. General support maintenance of motive power and rolling stock is provided to the group by the transportation railway diesel-electric locomotive repair company and the transportation

railway car repair company as indicated in paragraph 1-6c.

d. Headquarters and headquarters company, transportation railway battalion is the basic operating organization of the TRS. It is the operating organization for the smallest self-contained railway segment, the railway division (geograph-

ical limits of operations, 90-150 miles or 145-241 kilometers). The headquarters and headquarters company, transportation railway battalion, is assigned to the transportation command, TASCOM, and is attached further to a railway group. The group designates the geographical limits of the division which the battalion will operate.

Section II. SUPERVISORY AND COMMAND UNITS

2-4. Headquarters and Headquarters Company, Transportation Railway Brigade (TOE 55-201)

a. Mission. The mission of the headquarters and headquarters company, transportation railway brigade, is to command and provide operational planning, supervision, coordination, and control of the activities of transportation railway groups.

b. Assignment. This unit is assigned to a theater army support command (TASCOM) and normally is attached to a headquarters and headquarters company, transportation command.

c. Capabilities.

(1) Under level 1 organization, this unit provides—

(a) Command and supervision of three or more transportation railway groups (TOE 55-202).

(b) Command of, staff planning for, and supervision of operations.

(c) Supervision and assistance in matters of administration, supply, and training.

(d) Planning for and supervision of security of all buildings, structures, and equipment and of all supplies in transit by rail.

(e) Technical control over train movements; operation of terminals, railway shops, and enginehouses; car distribution; maintenance of track and structures; and allocation of motive power.

(f) Allocation of maintenance-of-way supplies and equipment.

(2) Under level 2 and 3 organization, the unit is adapted for reduced operational capabilities from approximately 90 percent at level 2 to 80 percent at level 3.

(3) This unit is not adaptable to a type B organization. (See para 2-7c for explanation of a B type unit.)

(4) Mobility of this unit is fixed.

d. Characteristics.

(1) This unit is dependent upon the personnel service company (TOE 12-67) for personnel administration, the finance service organization (TOE 14-500) for finance service support, the medical command for medical advice, and appropriate teams from medical department organization (TOE 8-600) to provide unit level medical support.

(2) A data processing team from TOE 11-500 or TOE 29-500 will be required for automatic data processing support.

e. Employment. The transportation railway brigade is assigned to the TASCOM transportation command. The brigade commands, plans, supervises, and controls the entire military railway system. When interzonal service is required, the brigade is authorized to operate in both the communications and combat zones. The transportation railway service (TRS) is comprised of adequate supervisory, operating, and maintenance units, as required, to operate trains, to maintain rail lines of communications, and to perform organizational and direct support maintenance on motive power, rolling stock, and power transmission facilities.

f. Organization. The brigade (fig 2-1) has a command section, a headquarters commandant, and a headquarters company. Personnel assignments and duties peculiar to this unit are as follows.

- (1) Chief of staff.
- (2) Information section.
- (3) Inspector general sections.
- (4) Judge advocate section.
- (5) Assistant chief of staff, personnel.
- (6) Adjutant general.
- (7) Assistant chief of staff, security, plans,

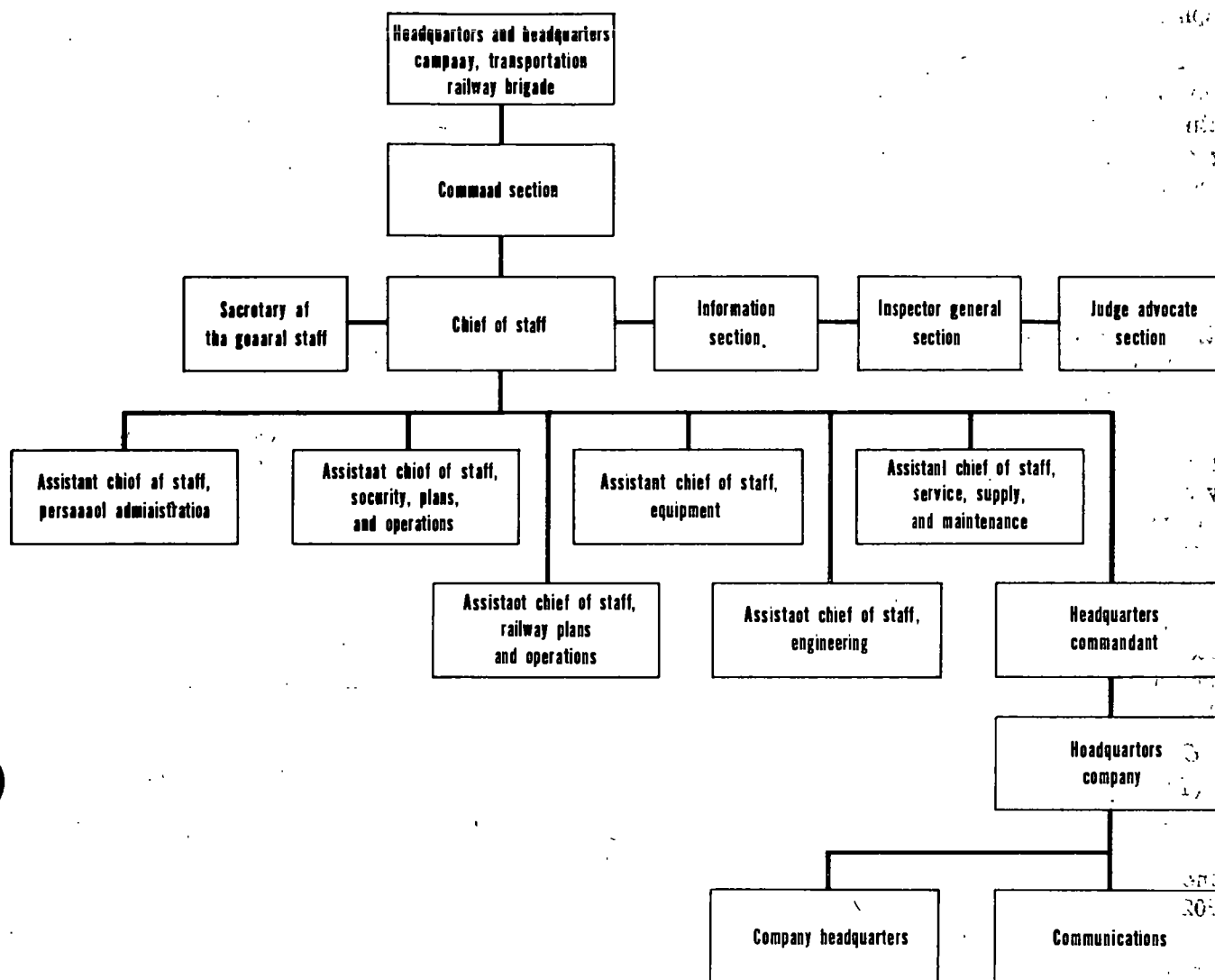


Figure 2-1. Headquarters and headquarters company, transportation railway brigade.

and operations. This officer, who is also the staff G2, is assisted by the following:

- (a) Training officer.
- (b) Communications-electronics officer.
- (c) Provost marshal.

(8) *Assistant chief of staff, railway plans and operations.* This section is on a 24-hour day operational basis. The assistant chief of staff, railway plans and operations, is responsible for the coordination of schedules and the assignment of motive power to groups. He supervises activities of his staff officers in their respective operational areas. These include—

- (a) Superintendent, terminals.
- (b) Superintendent, car service.

(9) *Assistant chief of staff, equipment.* This officer, a qualified railway equipment superintendent, is in charge of the equipment section. His responsibilities include determining the type of equipment needed to meet operating conditions and prescribing maintenance policies. He is assisted by the following officers:

(a) *Superintendent, motive power.* The motive power superintendent recommends assignment of motive power to meet requirements of the railway groups and operating battalions. He formulates rules for the operation and maintenance.

ance of locomotives and locomotive cranes. He provides adequate inspection service and exercises technical supervision over repair and maintenance of locomotives and locomotive cranes.

(b) *Chief mechanical engineer.* The chief mechanical engineer is charged with technical control over arrangement, operation, and maintenance of shop machinery and mechanical equipment of buildings. He formulates designs for modifications to locomotives and railway cars and determines changes, alterations, or improvement of equipment and shop practices.

(c) *Superintendent, car shops.* The superintendent of car shops exercises technical supervision over car shop operation. He prescribes rules governing methods of repair and shop practices and supervises procurement of car shop equipment.

(d) *Superintendent of locomotive shops.* The superintendent of locomotive shops exercises technical supervision over locomotive shop operation. He prescribes rules governing methods of repair and shop practices and supervises procurement of locomotive shop equipment.

(e) *Chief electrical engineer.* The chief electrical engineer has direct supervision over all electrical equipment used by subordinate units. This electrical equipment includes stationary power units assigned to the TRS. He assists the motive power superintendent, the shop superintendents, and the chief mechanical engineer in technical matters pertaining to electrical equipment.

(f) *Enlisted drafting personnel.*

(10) *Assistant chief of staff, engineering.* This officer, a qualified railway maintenance-of-way superintendent, is in charge of the engineering section. His responsibilities include coordination with the assistant chief of staff, railway plans and operations, in planning for the construction and rehabilitation of railway facilities. He has as assistants the following officers:

(a) Engineer, bridges and buildings, who exercises technical control over maintenance of bridges, tunnels, buildings, and all other railway structures on the rail lines of subordinate units.

(b) Construction liaison engineer, who provides coordination between the TRS and commanders of engineer construction forces engaged in railway construction and rehabilitation. He

insures that such work meets TRS standards. He may be assigned other engineering duties.

(c) Engineer, maintenance of way, who exercises technical supervision over maintenance of track and structures performed by subordinate railway units.

(d) Engineer, railway communications-electronics, who exercises technical control over installation and maintenance of signals, control tower apparatus, interlocking plants, and track circuits on the rail lines of subordinate units.

(e) Superintendent, water service, who exercises technical supervision over the location and operation of all railway locomotive water stations in subordinate units. He also exercises technical supervision over water treatment and the maintenance of piping and mechanical appliances connected with these water stations. He coordinates all railway requirements for water and arranges with the engineer service for adequate supply.

(f) Officer assistant (lieutenant) and enlisted draftsmen.

(11) *Assistant chief of staff, services, supply, and maintenance section.* This officer plans, coordinates, and supervises activities pertaining to local procurement of material and services for the brigade; food service; development of directives, plans, procedures, and policies in maintenance management and the logistics field for subordinate units. He is assisted by—

(a) *Railway storekeeper.* The railway storekeeper is responsible for estimating supply requirements and allocating critical supplies to units. He has two enlisted supply assistants.

(b) *Maintenance officer (motor).* He supervises the maintenance management functions of the command and conducts maintenance inspections.

(c) *Food adviser.* This officer exercises staff control over all food service activities of the brigade. He interprets regulations, disseminates instructions, and renders technical assistance to all subordinate food service activities.

(d) *Fuel agent.* The fuel agent looks for sources of fuel supply. He insures the maintenance of adequate fuel reserves on the rail lines of subordinate units.

(e) *Enlisted administrative and supply personnel.*

(12) *Headquarters commandant.* The headquarters commandant, a major, performs the duties and functions outlined for this position

by FM 101-5. He is assisted by an operations sergeant and clerical personnel.

(13) *Headquarters company.* The headquarters company commander is a captain. His responsibilities include the normal command, morale, supervision, and administrative activities for the enlisted personnel of the headquarters. He is also responsible for billeting, supply, training, messing of personnel, internal security guard, and operation and maintenance of motor vehicles for the brigade headquarters.

2-5. Headquarters and Headquarters Company, Transportation Railway Group (TOE 55-202)

a. Mission. The mission of the headquarters and headquarters company, transportation railway group, is to command, administer, and supervise the operation of the assigned and attached supporting units.

b. Assignment. This unit is assigned to the senior transportation organization in the theater. It normally is attached to a headquarters and headquarters company, transportation command or transportation railway brigade.

c. Capabilities.

(1) Under level 1 organization, this unit provides the following functions for from two to six transportation railway battalions and attached supporting units as required:

(a) Command of, staff planning for, and supervision of operations.

(b) Supervision and assistance in matters of administration, supply, and training.

(c) Planning for and supervision of security of all buildings, structures, and equipment and of all freight in transit by rail.

(d) Technical supervision over train movements; operation of terminals, railway shops, and enginehouses; car distribution; maintenance of track and structures; and allocation of motive power.

(e) Allocation of maintenance-of-way supplies and equipment.

(2) Under level 2 and 3 organization, the unit is adapted for reduced operational capabilities from approximately 90 percent at level 2 to 80 percent at level 3.

(a) Level 2 provides personnel and equipment for initiation of mission functions, but the unit must be provided level 1 authorizations for sustained performance.

(b) Level 3 provides personnel and equipment for limited performance of mission functions.

(3) This unit is not adaptable to a type B organization.

d. Characteristics.

(1) This unit is dependent upon the personnel service company (TOE 12-67) for personnel administration, the finance service organization (TOE 14-500) for finance service support, the medical command for medical staff advice, and appropriate teams from the medical department organization (TOE 8-600) to provide unit level medical support. It is also dependent on the direct support maintenance units of the theater army area command serving the area for organizational maintenance of aircraft, and headquarters and headquarters company, transportation railway battalion, TOE 55-226, for battalion level organizational maintenance.

(2) This unit will require attachment of a data processing team from TOE 11-500 or TOE 29-500 for automatic data processing support.

(3) This unit is not adaptable to a type B organization, (para 2-7c).

e. Employment. The headquarters and headquarters company, transportation railway group, commands the attached transportation railway battalions and other attached units.

f. Organization. This supervisory and administrative headquarters (fig 2-2) is organized so that it is capable of independent command when railway operations in a theater are not extensive enough to require a higher command. The transportation railway group is organized under TOE 55-202 with a headquarters company and a group headquarters organized into staff sections. When it is the only railway headquarters in the theater, the transportation railway group normally is under the operational control and staff supervision of the transportation command. The commander of headquarters company is responsible for company administration, billeting, messing, motor transport, vehicle maintenance, and supply for the headquarters. All other officers, including the group commander are assigned to the group headquarters. The executive officer supervises the staff sections and the subordinate component units. Both the group commander and the executive officer are qualified railway operations superintendents. Functions of the staff sections are discussed below.

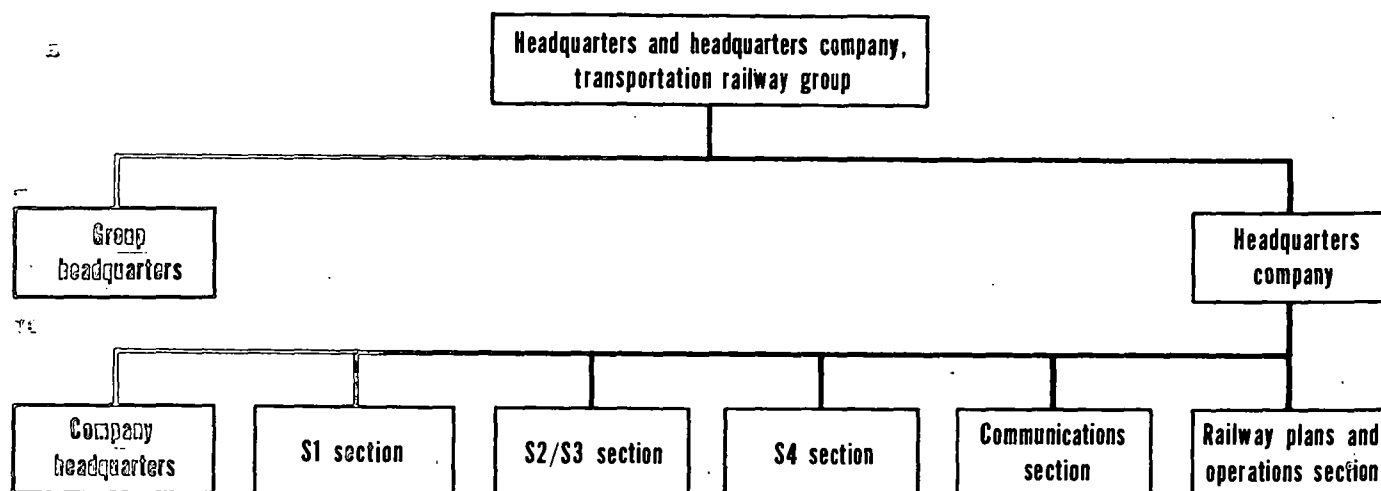


Figure 2-2. Headquarters and headquarters company, transportation railway group.

(1) *S1 section.* This section is supervised by the adjutant. He performs administrative and personnel duties required for the coordination of the military functions of the group.

(2) *S2/S3 section.* The S2/S3 officer is in charge of this section. He plans for and insures the proper security measures for all buildings, structures, equipment, and freight in transit by rail within the group's area of responsibility. He coordinates active and passive defense measures for the group and subordinate units. He also acts as group intelligence officer. He may exercise supervision over assigned or attached military police units. When the group is not supported by attached or area MP units, he may be assigned the additional duty of provost marshal.

(3) *S4 section.* This section is supervised by the railway maintenance officer (S4). He coordinates supply requirements of the subordinate battalions and exercises technical control over the battalion storekeepers. He is aided by an assistant railway supply officer (assistant S4). This section is divided into three principal operational elements as follows:

(a) *Unit supply and maintenance.* The maintenance officer is responsible for the maintenance and inspection program pertaining to all other than railway equipment. He is assisted by the food supervisor who inspects ration handling and food service operation and renders technical assistance to mess personnel on food preparation and sanitation.

(b) *Railway equipment maintenance.* The

locomotive-equipment maintenance officer is in charge of this section. He exercises technical control over the assignment, maintenance, and operation of motive power; the maintenance of cars and work train equipment; and the operation of shops and enginehouses. This section performs mechanical drafting services for the group as required.

(c) *Railway maintenance of way.* The chief maintenance-of-way engineer exercises technical control over all track, structures, track equipment, and roadbed maintenance including ballasting, grading, and drainage. He is assisted by the railway signals officer who is responsible for technical control of installation and maintenance of signals, control tower apparatus, interlocking plants, and track circuits. The bridges and buildings maintenance officer exercises technical supervision over the maintenance of bridges, tunnels, buildings, and other structures.

(4) *Communications section.* The communications-electronics officer, a major, plans and coordinates communication activities and advises the commander on communications-electronics matters. He is responsible for staff supervision of the communications section, which provides internal communications for the group. The communications officer, a lieutenant, supervises the enlisted personnel of the section and assists the group communications-electronics officer in planning communications for the group.

(5) *Railway plans and operations section.* The railway plans and operations officer, a qualified railway operations superintendent, super-

vises this section. He is responsible for the broad planning for rail operations in assigned areas and exercises technical control over train movements and terminal operations. He coordinates operational planning activities and prescribes the required train operational reports. This section operates 24 hours a day. He had an officer assistant (major). This section has two elements—

(a) *Plans branch.* This branch is responsible for long range planning for rail operations and coordination of operational planning activities of the railway group. It is staffed with officers technically qualified in car service, maintenance of way, railway equipment, and freight and passenger traffic operations.

(b) *Operations branch.* This branch, headed by a qualified railway operations officer, contains the key supervisors who are responsible for the operation of trains. The principal ones are—

(1) *Car service officer.* This officer is responsible for technical control of car distribution and car records. He compiles and distributes to shipping activities information concerning load limits and line clearances. When required, he traces lost cars and expedites and coordinates the movement of critical shipments.

(2) *Yardmasters.* Rail yardmasters are stationed at large terminals. They supervise the terminal railway operations and recommend to the group commander changes or improvements deemed necessary.

(3) *Trainmasters.* Trainmasters ride the trains throughout the group's territory. They oversee operations and engine and traincrew performance. They recommend changes in assigned motive power, train handling, operating procedures, and personnel utilization as required.

g. *Flight Support.* This is provided by one light observation helicopter with a crew of one warrant officer pilot and one enlisted crew chief. This organic aircraft provides the group commander and staff a means of rapid transport in order to exercise effective command and control over its widely dispersed units. The main line trackage within the territory of group responsibility may extend from 600 to 1,000 miles (965 to 1,609 kilometers). A metric conversion table is included for convenience (app E).

2-6. Headquarters and Headquarters Company, Transportation Railway Battalion (TOE 55-226)

a. *Mission.* The mission of the railway battalion is to exercise command, control, and su-

pervision over attached units and, with its attached units, to operate and maintain in a theater of operations of railway division of approximately 90-150 miles (145-241 kilometers).

b. *Assignment.* The headquarters and headquarters company, transportation railway battalion, normally is assigned to the transportation command, TASCOM, and is attached to a transportation railway group. When this company is the highest railway echelon in the theater, it operates directly under the control of the senior transportation unit.

c. Capabilities.

(1) Under level 1 organization, this unit has the following capabilities:

(a) Provides command, staff planning, administration, control, and supervision of operations of all assigned and attached units.

(b) Dispatches all trains, supervises on-line operations, and operates railway stations and signal towers for which it has responsibility.

(c) Maintains and repairs railway signals and communications.

(2) Under level 2 and 3 organization, the unit is adapted for reduced operational capabilities for approximately 90 percent at level 2 to 80 percent at level 3.

(3) The capabilities of a type B organization are the same as those of a level 1 organization.

(4) Mobility of this unit is fixed.

d. Characteristics.

(1) This unit is dependent upon the personnel service company (TOE 12-67) for personnel administration, the finance service organization (TOE 14-500) for finance service support, the medical command for medical staff advice, and appropriate teams from medical department organization (TOE 8-600) to provide unit level medical support.

(2) Individuals of this organization, except chaplain, can engage in effective, coordinated defense of the unit's area or installation. Defense of railway structures, bridges, tunnels, and trains in transit will require attachment of military police units.

e. Employment.

(1) As the basic unit of the military railway service, the headquarters and headquarters company, transportation railway battalion, as-

sumes responsibility for operation of a railway division (90-150 track miles (145-241 kilometers)). A railway division normally consists of main line tracks, sidings, passing tracks, terminals, enginehouses, and car repair tracks. Attached units of the railway battalion perform normal roadway maintenance and organizational and direct support maintenance to motive power, rolling stock, and railway signals, communications, and structures.

(2) The railway mileage assigned to the railway battalion will vary from 90-150 miles (145-241 kilometers); however, if military necessity dictates, the divisions may be extended. This may require attachment of teams from TOE 55-520. For planning purposes, a battalion is capable of operating an average of 10 trains daily in each direction on a single main line and 15 on a double main line between terminals of the railway division. Trains consist of 20 cars with a net trainload of approximately 400 short tons.

(3) Personnel of the headquarters and headquarters company are assigned to duties at locations as required for efficient operation of the railway division and according to the facilities available. Normally, the division serves at least one larger terminal. Station personnel and towermen are assigned to points along the railroad. The number of personnel at any station depends upon the amount of traffic to be handled. Personnel assignments are flexible to permit reassignment of station agents to handle any increase in traffic along any point of the division.

(4) The units normally attached to the head-

quarters and headquarters company, transportation railway battalion, are as follows:

(a) Transportation railway engineering company (TOE 55-227).

(b) Transportation railway equipment maintenance company (TOE 55-228).

(c) Transportation train operating company (TOE 55-229).

(5) When an electrified railway system is being operated, a transportation electric power transmission company (TOE 55-217) will be attached to the battalion to maintain and repair electric power transmission facilities.

(6) The units indicated in (4) and (5) above are discussed in section III of this chapter.

f. Organization. The headquarters and headquarters company, transportation railway battalion, consists of a battalion headquarters and a headquarters company. The battalion headquarters—the command element, is authorized two military occupational speciality (MOS) 0750's—the battalion commander and executive officer, a chief dispatcher S3, an adjutant, a chaplain, an S4, a communications officer, and a sergeant major. The company headquarters is authorized a company commander, a first sergeant, a supply specialist, a company clerk, and a light truck driver. Specific duties and responsibilities of key personnel of the battalion headquarters are as follows:

(1) The battalion commander receives and interprets directives to determine requirements for train service; formulates operating, maintenance-of-way, and equipment policies; inspects

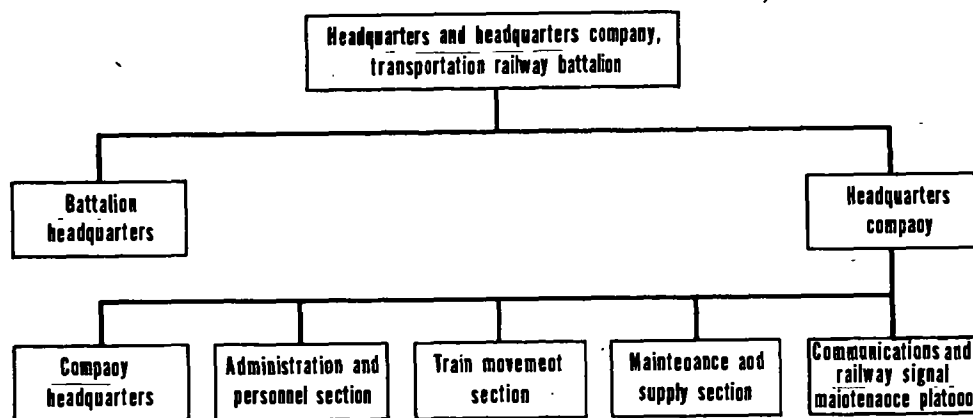


Figure 2-3. Headquarters and headquarters company, transportation railway battalion.

operation, equipment, and facilities to insure compliance with directives and to determine operating and maintenance efficiency. In addition, he exercises direct supervision over technical assistants in the planning for and performance of train control, maintenance of way and equipment, and train operation. He directs the keeping of records and the preparation of reports on railway operations.

(2) The executive officer assumes command in the absence of the battalion commander. His primary responsibility is to relieve the battalion commander of some of the details pertaining not only to the efficient operation and maintenance of the rail division, but also in preparation and execution of demolition plans, administration, training, supply, and the security of railway troops, equipment, and supporting facilities.

(3) The chief train dispatcher S3 supervises train movement personnel, directs the movement of trains, reroutes rail traffic in emergencies, determines train tonnage, arranges full tonnage trains, orders motive power, determines rail line capacity, and directs railcar setouts and pick-up's. He establishes train movement priority, coordinates train make-up and train departures with yardmasters, distributes motive power and traincrews over division, dispatches wreck train when required, expedites troop and hospital trains, and anticipates, prevents, and investigates train delays.

(4) The adjutant is responsible for railway personnel administrative services pertaining to the requisitioning, assignment, and transfer of railway personnel; organizational reports; and statistics. In addition, he publishes, authenticates, and distributes battalion orders and operates the postal service.

(5) The battalion S4 officer is responsible for determining fuel and supply requirements of the battalion. He requisitions, stores, and distributes supplies, materials, fuel, and ammunition as required. In addition, he is responsible for insuring that motor vehicles are maintained in accordance with applicable regulations. A motor officer is not authorized in TOE 55-226.

(6) The communications-electronics officer arranges for and coordinates the requirement for establishment of communication between adjoining battalions, higher rail echelons, and transportation movement agencies. He directs the installation and operation of internal communications between headquarters and subordinate units and provides technical assistance to the railway communications-electronics maintenance supervisor in matters pertaining to the operation and maintenance of railway dispatching and message lines.

g. Company Headquarters. The company headquarters includes the mess steward, cooks, supply sergeant, motor sergeant and other personnel specified in TOE 55-226.

Section III. MAINTENANCE AND OPERATING UNITS

2-7. Transportation Railway Engineering Company (TOE 55-227)

a. Mission. The mission of the railway engineering company is to maintain and repair railroad track, bridges, and buildings within a railway division.

b. Assignment. The railway engineering company is assigned to the transportation command, theater army support command (TASCOM), and normally is attached to a headquarters and headquarters company, transportation railway battalion.

c. Capabilities.

(1) The railway engineering company is capable of maintaining and repairing the railway tracks, bridges, and buildings for a railway division of 90-150 miles (145-241 kilometers) operated by the transportation railway battalion to which it is attached.

(2) The reduced strength column adapts this table of organization and equipment (TOE) to the lesser requirements for personnel and equipment during prolonged noncombat periods and for a limited period of combat.

(3) The capabilities of a type B organization are the same as that of a full strength organization.

(a) The type B column adapts this TOE to the lesser requirements for US military personnel. Vacancies existing in the type B column are indicative of the type of positions which can be filled by non-US personnel. The number of non-US personnel must be determined by the major command to which the unit is assigned and will depend upon capacity of available personnel to produce, number of shifts, and other local conditions.

(b) Interpreters and translators required

when organized under the type B column will be provided from appropriate teams available to the theater commander.

(c) Authorization of US military personnel shown in the type B column may be modified by troop basis proponents as required by local area conditions of employment to enable the unit to accomplish its mission effectively.

d. Characteristics.

(1) The railway engineering company is not administratively self-sufficient. It is dependent upon the personnel services company (TOE 12-67) for personnel administration, the finance service organization (TOE 14-500) for finance support, and appropriate teams from medical department organization (TOE 8-600) to provide unit level medical support.

(2) Organic transportation is provided for administrative, logistic, and supervisory missions. This unit cannot move itself with its organic motor transportation.

e. Employment. The railway engineering company normally is attached to and operates under the command and supervision of a headquarters and headquarters company, transportation railway battalion; normal attachment is one company to a battalion. It performs maintenance and repair on track, bridges, and structures of a railway division on a 24-hour basis. Maintenance

and repair include inspection of track, roadbeds, bridges, culverts, building, water towers, and other railway structures to determine the extent and nature of maintenance and required repairs. When major construction and/or rehabilitation beyond the capability of this unit is required, the senior railway headquarters in the theater requests and coordinates the support requirement with the theater engineer command. In a major construction or rehabilitation project, the railway engineering company cooperates closely with engineer units, providing technical advice as required. The maintenance and repair performed by this company is discussed in TM 55-204.

f. Organization. This company consists of a company headquarters and four platoons (fig 2-4):

(1) Company headquarters consists of the company commander (a maintenance-of-way superintendent), and the enlisted personnel provided in TOE 55-227. As the maintenance-of-way superintendent, he is directly responsible for all engineering pertaining to maintenance of way and insures that a sufficient stock of emergency materials such as rail, fastenings, and ties are stored at key points along the line. He has the usual military administrative responsibilities for his company. His territorial limits conform to those of the battalion.

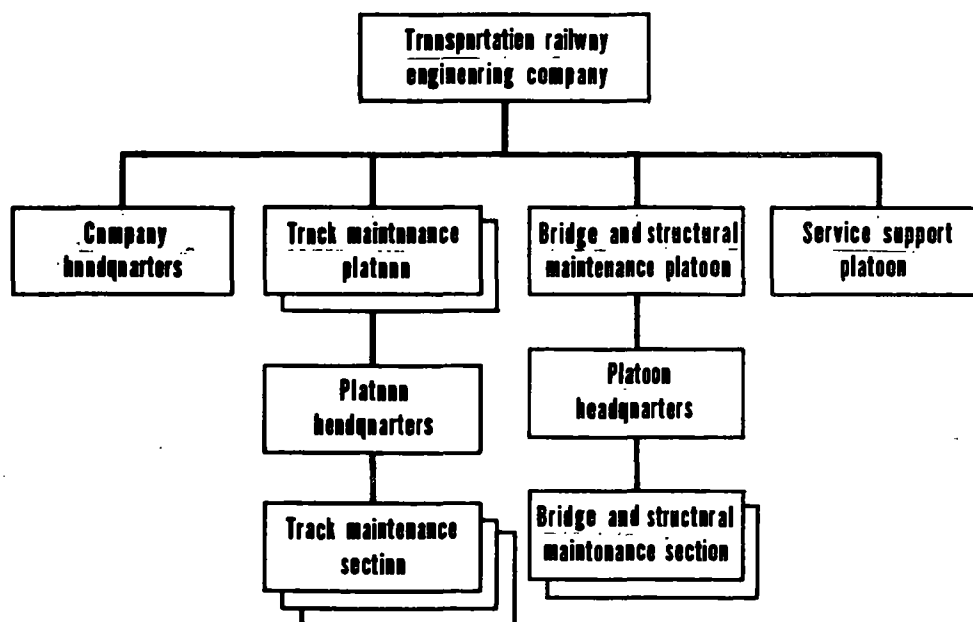


Figure 2-4. Transportation railway engineering company, transportation railway battalion.

(a) The first sergeant has charge of all routine matters of the company including the preparation of routine reports, maintaining organization records, issuing orders, and other assigned duties.

(b) The supply sergeant is in charge of the receipt and issue of maintenance-of-way supplies of the battalion and of individual and organizational supplies of the company. Assisted by the supply clerk and driver, he maintains proper stock levels, notes supply requirements of the platoons, and prepares and forwards supply requests. He works under the technical supervision of the division storekeeper.

(c) Other personnel of company headquarters include the section foreman, armorer, supply clerk, vehicle driver, and company clerk. The latter prepares the company records. The company clerk and the vehicle driver report to the first sergeant. Supply personnel normally report to the supply sergeant. Duties are indicated by the titles of personnel.

(2) Each of the two track maintenance platoons has a headquarters, three track maintenance sections, and personnel assigned as provided in TOE 55-227. Platoon personnel are responsible for the safe condition and proper maintenance of roadbed, track, tunnels, right-of-way, station grounds, driveways, crossings, and line-of-road markers within the limits of the railway division.

(a) *Platoon headquarters.* The platoon headquarters is composed of the platoon leader, a track maintenance foreman, welders, compressor operators, blacksmiths, and truck drivers. It supervises and coordinates the activities of the track maintenance sections, distributes tools and materials, and prepares and forwards supply requests and other routine inspection reports. The platoon leader, who is a track supervisor, receives instructions from the maintenance-of-way superintendent. He assigns the territorial limits to the track maintenance sections and prescribes the specific work projects. The platoon leader is responsible for the frequent inspection of track, roadbed, fills, drainage ditches, tunnels, line-of-road markers, and highway grade crossings. He examines track maintenance personnel on operational and safety rules. In the event of a train accident or line obstruction, the platoon leader and a section gang proceed with the wreck train to repair the track after it has been cleared by the wreck crew of the equipment maintenance company. He is responsible for all TOE 55-227

property in his assigned territory, for maintaining an adequate supply of material for repair of all right-of-way fixed rail facilities, and for discipline and training.

(b) *Track maintenance section.* Each of the six track maintenance sections, composed of the section gang foreman and section workers, is responsible for all maintenance of way within its assigned territory. The gang foreman is responsible for the work, supervision, discipline, and technical training of his men. He has the responsibility for all maintenance-of-way tools and supplies. Under his direction, inspection is made of track, roadway, bridges, culverts, station grounds, tunnels, milepost signs, and highway grade crossings.

(3) The bridge and structural maintenance platoon consists of a platoon headquarters and two bridge and structural maintenance sections. The principal duty of the platoon is inspection of bridges, culverts, tunnels, fueling and watering facilities, and buildings to determine maintenance requirements.

(a) *Platoon headquarters.* Platoon headquarters consists of the platoon leader, a platoon sergeant, assistant platoon sergeant, water supply specialists, welders, blacksmiths, plumbers, pumping station operators, and truck drivers. The platoon headquarters furnishes technical supervision and coordinates and inspects the work of the two bridge and structural maintenance sections. Personnel perform the duties indicated by their titles.

(b) *Bridge and structural maintenance sections.* Each bridge and structural maintenance section is organized and equipped to maintain structures. The construction foreman is in charge of the section, supervises the work, and is responsible for the discipline, the care, and the feeding of his men. He must insure that there are no delays to the work because of lack of materials and tools. Included in the section are structural steel workers, construction workers, riggers, welders, and carpenters.

(4) The platoon leader of the service support platoon is a maintenance-of-way officer with the mission of providing service support to the three mission platoons. This platoon includes the engineer equipment maintenance supervisor; a construction surveyor; construction draftsman; survey recorder; equipment mechanics; crane shovel, forklift, and vehicle operators; equipment reports clerk; and other maintenance personnel. The platoon provides engineering and survey serv-

ices, furnishes heavy hauling equipment, and provides maintenance services for the company.

2-8. Transportation Railway Equipment Maintenance Company (TOE 55-228)

a. Mission. The mission of the railway equipment maintenance company is to provide organizational and direct support maintenance on motive power and rolling stock.

b. Assignment. The equipment maintenance company is assigned to the transportation command, TASCOM, and normally is attached to a headquarters and headquarters company, transportation railway battalion.

c. Capabilities.

(1) The equipment maintenance company is capable of performing organizational and direct support maintenance on approximately 40 diesel-electric locomotives and 800 railway cars and can perform organizational (running) inspection on 2,000 cars daily. It performs light repairs on tools and limited repairs on special mechanical equipment within the battalion.

(2) The reduced strength column adapts this TOE to the lesser requirements for personnel and equipment during prolonged noncombat periods and for a limited period of combat.

(3) The capabilities of a type B organization are the same as those of a full strength organization.

(a) The type B column adapts this TOE to the lesser requirements for US military personnel. Vacancies existing in the type B column are indicative of the types of positions which can be filled by non-US personnel. The number of non-US personnel must be determined by the major commander to which the unit is assigned and will depend upon capacity of available personnel to produce, number of shifts, and other local conditions.

(b) Interpreters and translators required when organized under the type B column will be provided from appropriate teams available to the theater commander.

(c) Authorization of US military personnel shown in the type B column may be modified by troop basis proponents as required by local area conditions of equipment to enable the unit to accomplish its mission effectively.

(4) Mobility of this unit is fixed.

d. Characteristics.

(1) The equipment maintenance company is not administratively self-sufficient. It is dependent upon the personnel services company (TOE 12-67) for personnel administration, the finance service organization (TOE 14-500) for finance support, and appropriate teams from medical department organization (TOE 8-600) to provide unit level medical support.

(2) Organic transportation is provided for administrative, logistic, and supervisory missions. This unit cannot move itself with its organic motor transportation.

e. Employment. The railway equipment maintenance company is attached to and operates under the command and supervision of a headquarters and headquarters company, transportation railway battalion; normal attachment is one company to a battalion. Upon entry into a theater of operations, equipment maintenance personnel inspect available motive power and rolling stock and estimate the time required to place them in service; equipment requiring repairs beyond the capability of the unit is evacuated to the general support units for repair. Personnel of the railway equipment maintenance company also inspect enginehouses, shops, fueling and watering stations, and other facilities used in rolling stock maintenance. During subsequent operations, motive power and railway cars are kept in proper operating condition by performance of organizational and direct support maintenance as required. Personnel of this unit operate a wreck train to clear the tracks and to repair or salvage detailed or wrecked motive power and cars. This unit also maintains the necessary level of diesel fuels and other supplies of lubricants, oils, solvents, and repair parts for organizational and direct support maintenance on motive power and rolling stock and operates fueling, watering, and lubricating facilities. When necessary, this unit implements the battalion demolition plan for the destruction of shop equipment, motive power, and railway cars. (STANAG 2113, app G.) The maintenance of diesel-electric locomotives and railway cars is discussed in TM 55-202 and 55-203, respectively.

f. Organization. This unit is composed of a company headquarters, a car repair platoon, and a diesel-electric locomotive repair platoon (fig 2-5). In the event steam locomotives are used, the company will be augmented with steam locomotive maintenance crews, direct support (DS), from TOE 55-520.

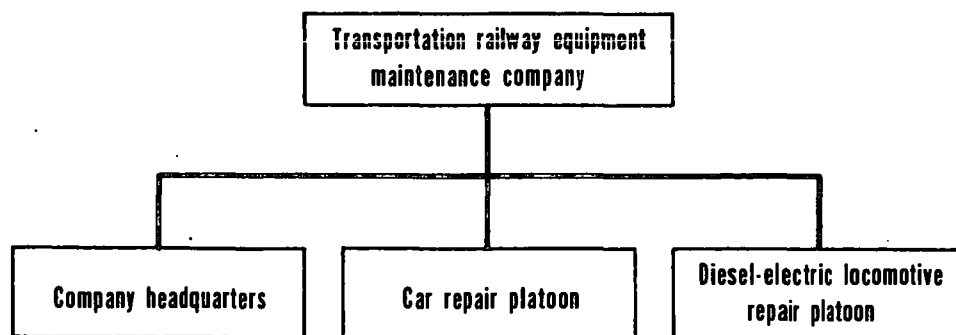


Figure 2-5. Transportation railway equipment maintenance company, transportation railway battalion.

(1) The company commander is a qualified railway master mechanic, military occupational speciality (MOS) MOS 0735, and is responsible for the military administration and the operational performance of the company. He assigns personnel and insures cooperation with the other companies to facilitate the function of the battalion in accomplishing its mission. He prescribes rules and regulations for the protection of enginehouses and other facilities from fire and other damage and makes periodic inspections to see that they are being observed. The company commander also has direct charge of the drafting room and is responsible for the procurement, storage, and issue of TOE tools, materials and supplies. He insures that all rules governing equipment inspection, tests, and maintenance are followed. He maintains a record of the condition of locomotives and cars and performs such other duties as prescribed by the battalion commander. Personnel under his direction include a first sergeant, a supply sergeant, a company clerk, a draftsman, a light truckdriver, and two supply specialists.

(2) The car repair platoon is responsible for maintenance, repair, and inspection of cars and operation of the wreck train. It performs light car repairs and inspects for defects, the cars passing over the division. The platoon consists of the platoon leader (car foreman), car shop foreman, car inspectors, car repairmen, airbrake repairmen, blacksmith, welders and other mechanics. The platoon leader is responsible for the operation of the car repair shop. He is responsible for the discipline and training of his men, inspecting and testing airbrakes and air equipment, car inspections, and the supply of car parts and repair materials. He represents the railway equipment maintenance company at wrecks and makes certain that damage to equip-

ment is held to a minimum when clearing up wrecks. The car shop foreman assists the platoon leader, coordinates the car repair work, and requisitions repair materials. The car shop foreman is in charge of the car repair shop and supervises the work. The foreman advises the supply sergeant of the material requirements of the shop. The occupational titles of the following personnel indicate their normal duties, although they may be assigned other additional duties: car repairmen, airbrake repairmen, blacksmiths, metal workers, and welders. Wreck crews, made up from the car repair platoon, operate equipment assigned to the wreck train and assist in clearing wrecks and other line obstructions. The duties of wreck crews are thoroughly discussed in TM 55-207. Wreck crew personnel include a senior car repairman designated as wreck crew foreman, and necessary car repairmen, wreck crane operators, electricians, and welders.

(3) The diesel-electric locomotive repair platoon is responsible for operation of enginehouses; maintenance and running repairs to locomotives, cranes, and other allied equipment; and the fuel and lubrication facilities. The platoon is organized to operate a 4-hour day. The platoon leader is designated the diesel locomotive shop superintendent. He is generally responsible for all facilities used in connection with servicing and repair of motive power, materials and tools, and inspection of locomotives including sand, water, fuel, and lubrication. He insures that hostlers switch the locomotives promptly from the shop to ready tracks after determining they have been properly inspected, supplied, and are in condition for road and yard service. He conducts inspections to see that safety rules and regulations are followed by personnel under his jurisdiction. The diesel locomotive shop superintendent is assisted by the diesel-electric locomotive

shop foreman. The shop foreman is directly responsible for servicing of and running repairs to diesel-electric locomotives. Other personnel consists of the assistant shop foreman, a master machinist, toolmakers, airbrake repairmen, electricians, machinists, welders, diesel-electric locomotive repairmen, crane operators, and other personnel required to insure round-the-clock service.

2-9. Transportation Train Operating Company (TOE 55-229)

a. Mission. The mission of the train operating company is to provide road and yard personnel for the operation of railway locomotives and trains.

b. Assignment. The train operating company is assigned to the transportation command, TASCOM, and normally is attached to a headquarters and headquarters company transportation railway battalion.

c. Capabilities.

(1) Under level 1 organization, this unit has the following capabilities:

(a) Operates trains and locomotives in both yard and road service and performs incidental switching service for a railway division 90-150 miles (145-241 kilometers) long on an around-the-clock basis.

(b) Performs the necessary switching and train buildup in a large terminal, including port clearance up to a 20-mile (32-kilometer) radius from a large port.

(c) Provides 40 traincrews daily for road and/or terminal operation, including switching, classifying, and making up trains for the road.

(2) Under level 2 and 3 organization, this unit is adapted for reduced operational capabilities from approximately 90 percent at level 2 to 80 percent at level 3.

(3) The capabilities of a type B organization are the same as those of a level 1 organization.

(a) The type B column adapts this TOE to the lesser requirement for US military personnel. Vacancies existing in the type B column are indicative of the types of positions which can be filled by non-US personnel. The number of non-US personnel must be determined by the major commander to which the unit is assigned and will depend upon capacity of avail-

able personnel to produce, number of shifts, and other local conditions.

(b) Interpreters and translators required when organized under the type B column will be provided from appropriate teams available to the theater commander.

(c) Authorization of US military personnel shown in the type B column may be modified by troop basis proponents as required by local area conditions of employment to enable the unit to accomplish its mission effectively.

d. Characteristics.

(1) The train operating company is dependent on the personnel service company (TOE 12-67) for personnel administration and upon the finance service organization (TOE 14-500) for finance support.

(2) Organic transportation is provided for administration, logistic, and supervisory missions. This unit cannot move itself with its organic motor transportation.

e. Employment. The train operating company provides traincrew personnel for operation of main line freight and passenger trains and yard crew personnel for switching requirements in yards and terminals, including yardmasters and yard clerks. Traincrews in main line service are supervised by assistant trainmasters and road foremen of engines. Operational control of all main line trains is exercised by the train dispatcher. While within yard limits, they are under the supervision of the yardmaster. This company provides road and yard personnel for the operation of trains and switching crews of the transportation railway battalion to which assigned or attached, within the assigned limits of the battalion's area, including the switching at stations, depots, docks, and at service installations. Operating and safety rules for transportation railway service personnel are contained in TM 55-200.

f. Organization. The train operating company consists of the company headquarters and two train operating platoons (fig 2-6).

(1) *Company headquarters.* The company headquarters is staffed by the company commander, the road foreman of engines, and the yardmasters. Noncommissioned personnel consist of a first sergeant, senior assistant yardmasters, assistant yardmasters, supply sergeant, and additional enlisted personnel shown in TOE 55-229. The company provides personnel for sup-

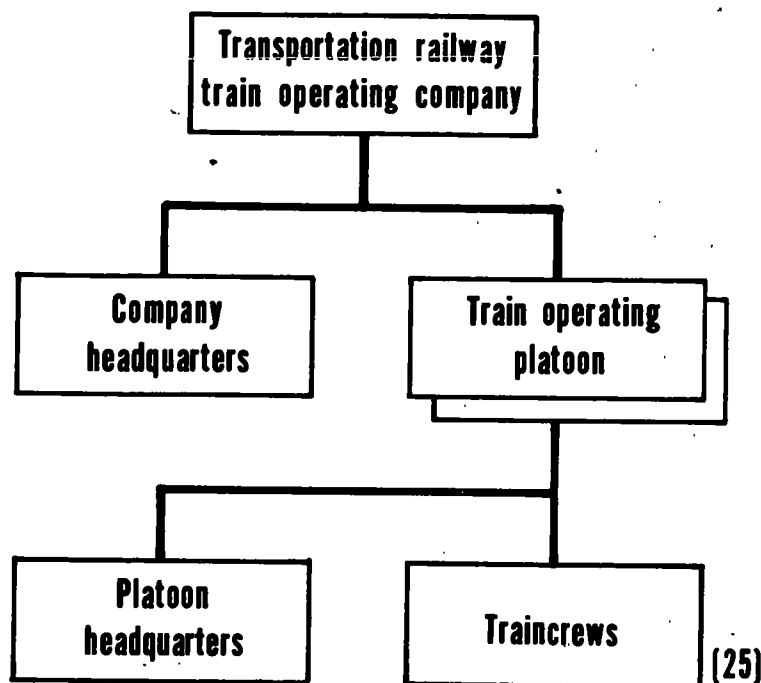


Figure 2-6. Transportation train operating company, transportation railway battalion.

Supervision, inspection, and administration of the company and for the operation of the yards and terminals. The company headquarters is responsible for records and reports. The company commander's duties are analogous to those of a trainmaster on a civilian railway division, for example, the operation of road trains and yard switching. He is assisted by the first sergeant and company clerk in the military administration of the company, including housing and care of company personnel.

(a) The company commander is responsible for safe and efficient operation of locomotives and trains and for strict compliance with all operating and safety rules by personnel of the company. In the absence of instructions from higher authority, he prescribes in special timetable instructions, rules, and regulations required for safe and efficient yard service and road movements. He insures the prompt and regular movement of trains over the division, and he investigates train delays and accidents. He analyzes delays and takes positive action to preclude their recurrence. He inspects the condition of passenger equipment and sees that the cars are properly and fully used. He coordinates with the train movement section of the headquarters

company and makes constructive recommendations to expedite train movements.

(b) The road foreman of engines, a lieutenant (MOS 0720), is directly responsible for the efficient handling of locomotives by the engine-men; he reports to the trainmaster. He coordinates with the master mechanic to insure proper mechanical condition and efficient performance of division motive power. He supervises the training and assignment of locomotive crews, spends a great deal of his time on the road observing crew performance and train operation, and supervises the senior enlisted road foreman assigned to the platoons. They in turn, supervise the locomotive crews on the road and in terminals to insure compliance with rules and safe and efficient operation of the motive power in their charge. They ride locomotives and instruct engine-men in technical aspects of proper locomotive handling and must do everything possible to see that engine failure and delays are held to the minimum. They report mechanical defects to maintenance personnel and fuel and water deficiencies to the train dispatcher. They prepare locomotive performance records, report locomotive and locomotive crew failures, and inform the road foreman of engines of the condition of locomotives.

when received from enginehouses and of their performance during the assigned tour of duty.

(c) The yardmaster reports to the company commander who serves as the division trainmaster. His duties and responsibilities are discussed in TM 55-206.

(d) Other personnel include the first sergeant, supply sergeant, armorer, company clerk, supply clerk, and truck drivers, who perform normal administrative and supply functions.

(2) *Train operating platoon.* There are two train operating platoons, each composed of a platoon headquarters and 25 traincrews. The platoons provide the personnel for train movements and yard switching operations.

(a) *Platoon headquarters.* Each platoon headquarters in the company includes a platoon leader who acts as assistant trainmaster. His enlisted personnel include one senior road foreman of engines, one road foreman of engines, five senior brakemen, five brakemen, two senior crew dispatchers, two crew dispatchers, and 25 train and engine crews as provided in TOE 55-229. The platoon leader is responsible for the discipline, housing, and general care of the personnel in his assigned territory. He enforces rules and regulations for safe and efficient operation of trains, and insures compliance with special instructions. The crew dispatchers are charged with maintaining the crew roster, or crew board, and responsible for traincrews being called sufficiently in advance to insure their availability. As directed by the platoon leader, they perform administrative and clerical duties pertaining to the operation and performance of traincrews.

(b) *Traincrews.* Traincrews operate main line freight or passenger trains, or, as yard crews, perform switching in yards and terminals. The conductor is responsible for the entire crew's duty performance. The brakemen report to and receive their instructions from the conductor. The engineman is responsible for the efficient operation of the locomotive and for strict compliance with all train orders, rules, and special instructions in the timetable. Train orders and signal indications are repeated by enginemen and traincrewmen to each other when two are present on the locomotive or in the caboose. (The duties of main line traincrews and those of yard switch crews are discussed in detail in TM 55-206.)

2-10. Transportation Electric Power Transmission Company (TOE 55-217)

a. *Mission.* The mission of the electric power

transmission company is to maintain and repair electric power transmission facilities.

b. *Assignment.* The electric power transmission company is assigned to the transportation command, TASCOM, and normally is attached to a headquarters and headquarters company, transportation railway battalion.

c. Capabilities.

(1) Under level 1 organization, this unit maintains and repairs electric power transmission facilities, including substation and catenary, for 200 miles (321 kilometers) of electrified railway including side tracks, passing tracks, and yard tracks.

(2) Under level 2 and 3 organization, the unit is adapted for reduced operational capabilities for approximately 90 percent at level 2 to 80 percent at level 3.

(3) The capabilities of a type B organization are the same as those of a level 1 organization.

(a) The type B column adapts this table to the lesser requirements for US military personnel. Vacancies existing in the type B column are indicative of the types of positions which can be filled by non-US personnel. The number of non-US personnel must be determined by the major commander to which the unit is assigned and will depend upon capacity of available personnel to produce, number of shifts, and other local conditions.

(b) Interpreters and translators required when organized under the type B column will be provided from appropriate teams available to the theater commander.

(c) Authorization of US military personnel shown in the type B column may be modified by troop basis proponents as required by local area conditions of employment to enable the unit to accomplish its mission effectively.

d. Characteristics.

(1) This unit is dependent upon the personnel service company (TOE 12-67) for personnel services and upon the finance service organization (TOE 14-500) for finance support.

(2) Organic transportation is provided for administrative, logistic, and supervisory missions and provides the unit with a 15-percent mobility capability.

e. *Employment.* The electric power transmission company normally is attached to a head-

quarters and headquarters company, transportation railway battalion. It is employed only when an electrified system is to be operated and when such operation cannot be accomplished by using local civilian personnel.

f. Organization. The company is composed of a headquarters and two electric power platoons (fig 2-7). Their functions are as follows:

(1) *Company headquarters.* The company headquarters consists of the company commander (electric power transmission superintendent), line construction supervisor, first sergeant, mess steward, supply sergeant, and additional enlisted personnel as shown in TOE 55-217. The headquarters is responsible for normal administration, discipline, mess, and supply of the company. It supervises the electric power platoons.

(a) The company commander reports to the battalion commander. He is responsible for seeing that an adequate quantity of materials and supplies is maintained. He must cooperate closely with other units of the battalion to facilitate all operations.

(b) The second in command assists the company commander in the administration of the unit. He supervises the organizational and direct support maintenance and minor repair of electric power transmission facilities required for operation of electric locomotives.

(c) The high voltage line construction supervisor supervises repair and maintenance of all power distribution lines. The initial rehabilitation is an engineer responsibility.

(d) Other personnel include the first sergeant, food service steward, company clerk, and supply clerk who perform normal administrative, food service, and supply functions.

(2) *Electric power platoons.* There are two electric power platoons in the company. Each is headed by an electric power transmission officer who reports to the company commander. Included in each platoon is a line construction foreman, senior cable splicer, substation supervisor and

operators, and additional technical personnel as shown in TOE 55-217. The platoon is responsible for the operation, maintenance, and repair of electrical transmission systems. It is organized for 24-hour operation.

(a) The line construction foreman reports to the electric power transmission officer and supervises the work of the line teams, cable splicer, and any other repairmen.

(b) The substation supervisor, who reports to the electric power transmission officer, supervises the activities of the substation operators and electricians. He is charged with responsibility for the proper load and distribution of electric current over the railway division.

(3) *Other personnel.* When circumstances require more power substation personnel than is provided by the TOE, additional support should be requested from the TASCOM engineer service.

2-11. Other Maintenance Units

a. General. General support maintenance, or heavy maintenance beyond the capabilities of the battalion railway equipment maintenance company, is provided by two additional companies. Under current doctrine, these two units are separate companies. They are assigned to a field depot of the TASCOM materiel command, but may be located in the vicinity of the units which they support. Their functions are discussed below.

b. Transportation Diesel-Electric Locomotive Repair Company. Organized under TOE 55-247, this unit consists of a company headquarters and two platoons, one diesel engine platoon, and one diesel-electric platoon. The mission of this unit is to perform general support maintenance on diesel-electric locomotives and railway cranes; see TM 55-202. This company is capable of repairing under-carriages and removing and installing traction motors, wheels, bearings, draft gears, safety appliances, headlights, brake gear, etc. Other duties include required electrical work, such as winding, baking, and testing armatures; repairing electrical control equipment, panel boards, motors, and electric switches; and inspecting diesel-electric locomotive units. It also has the capability of assembling and testing new locomotive units. When the company has its authorized personnel, it has the capability of performing general support maintenance on a maximum of 25 diesel-electric locomotives and/or railway cranes per month.

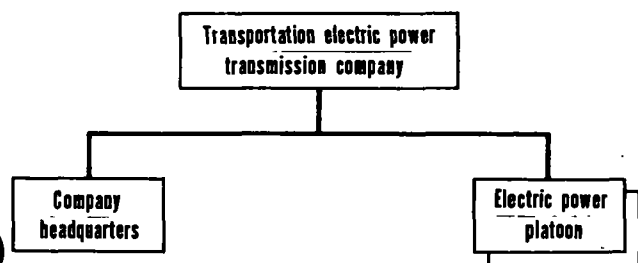


Figure 2-7. Transportation electric power transmission company.

c. Transportation Railway Car Repair Company (General Support) (TOE 55-248). This unit performs general support maintenance which involves stripping, fabricating, assembling, erecting, welding, and painting in support of 2,500 railway cars. It is capable of dismantling, assembling, and repairing boxcars, flatcars, gondola cars, tank cars, hospital cars, passenger cars, and special purpose cars—including bodies running gear, and airbrake components; see TM 55-203. It is capable of performing general support maintenance on 600 railway cars per month.

Section IV. TRANSPORTATION RAILWAY SERVICE TEAMS

2-12. General

Transportation railway service teams organized under table of organization and equipment (TOE) 55-520 are available for employment within the transportation railway service. These teams are employed to increase the capabilities of railway service operating and maintenance units to meet requirements that exceed the capabilities of such units but are not sufficient to warrant the assignment of additional TOE units to the railway service.

a. Mission. The missions of individual teams are given in paragraph 2-13 below.

b. Assignment. Assignment of individual teams is given in paragraph 2-13 below. A team may be attached or assigned as required to higher echelon units or may be organized into service units to perform the functions required by existing conditions.

c. Capabilities.

(1) Capabilities for individual teams are given in paragraph 2-13 below.

(2) These teams are not adaptable to strength levels 2 and 3.

(3) These teams are not adaptable to type B organization except as noted for specific teams in paragraph 2-13 below.

(4) When type B strength is shown, the capabilities are the same as those of a full strength organization.

(a) The type B column adapts the teams to the lesser requirements for US military personnel. Vacancies existing in the type B column are indicative of the types of positions which can be filled by non-US personnel. The number of non-US personnel must be determined by the major commander to which the unit is assigned and will

This unit has a supply mission also. When sources of supply are not available in the area of operation, this company may be assigned the responsibility for supplying repair parts for organizational and direct support maintenance of railway equipment. It has the capability of receiving, storing, and issuing 8,000 line items per month in support of four to six railway battalions. It is organized with a company headquarters, one stripping and erecting platoon, one shop platoon, and a railway supply platoon.

depend upon capacity of available personnel to produce, number of shifts, and other local conditions.

(b) Interpreters and translators required when organized under type B strength will be provided from appropriate teams available to the theater commander.

(c) Authorization of US military personnel shown in the type B column may be modified by troop basis proponents as required by local area conditions of employment to enable the unit to accomplish its mission effectively.

(5) Unless specifically provided for in the individual teams, these teams must be furnished personnel, administration, supply, mess, and organizational maintenance service. If not provided by the unit to which attached or assigned, mess and automotive maintenance teams will be drawn from TOE 29-500. Other service support will be drawn from appropriate service organization TOE of the service concerned or provided on an area basis as required. Teams may be grouped under appropriate TOE 55-500 headquarters elements for command control.

d. Basis of Allocation. Basis of allocation is given for individual teams in paragraph 2-13 below.

e. Category. These teams are designated as category III teams.

f. Mobility. Mobility for individual teams is given in paragraph 2-13 below.

2-13. Detailed Breakdown of Teams

a. Team EA, Ambulance Train Maintenance Detachment (Direct Support).

(1) *Mission.* To perform running repairs on ambulance train railway cars.

(2) *Assignment.* To the senior transportation railway unit in a theater of operations.

(3) *Capabilities.* Performing running repairs on one ambulance train.

(4) *Basis of allocation.* One per ambulance train.

(5) *Mobility.* One hundred percent mobile by rail.

b. Team EB, Ambulance Train Maintenance Detachment (Augmentation).

(1) *Mission.* Augmenting railway car repair crew when required to perform direct support maintenance repairs on ambulance trains.

(2) *Assignment.* To a railway car repair crew (direct support) team EH.

(3) *Capabilities.* Provides refrigeration and supply specialists necessary for direct support maintenance of four ambulance trains.

(4) *Basis of allocation.* One per four ambulance trains to be maintained.

(5) *Mobility.* Fixed.

c. Team EC, Railway Station Detachment.

(1) *Mission.* To operate on on-line railway station.

(2) *Assignment.* To a transportation railway battalion or comparable unit.

(3) *Capabilities.*

(a) Providing a detachment to operate a small or medium-size on-line railway station facility in a depot or other installation served by the transportation railway service.

(b) Augmenting a transportation railway battalion.

(4) *Basis of allocation.* One for each on-line railway station or depot railway station facility required when the number of such stations to be operated exceeds the capabilities of a transportation railway battalion.

(5) *Mobility.* Fixed.

d. Team ED, Railway Terminal Detachment.

(1) *Mission.* To operate a railway terminal on a 24-hour basis.

(2) *Assignment.* To a transportation railway battalion or comparable unit.

(3) *Capabilities.* Operating a railway terminal with a capacity of 10 trains per day.

(4) *Basis of allocation.* One per railway terminal when the number of such terminals to be

operated exceeds the capabilities of a transportation railway battalion.

(5) *Mobility.* Fixed.

e. Team EE, Railway Section Crew.

(1) *Mission.* To perform railway maintenance way.

(2) *Assignment.* To a transportation railway battalion, or comparable unit.

(3) *Capabilities.*

(a) Maintaining approximately 15 track miles (24 kilometers) (tracks, roadbeds, switches, and miscellaneous railway facilities).

(b) Adaptable to type B organization.

(4) *Basis of allocation.* As required in consonance with stated capability.

(5) *Mobility.* One hundred percent mobile by rail.

f. Team EF, Steam Locomotive Maintenance Detachment (Direct Support).

(1) *Mission.* To perform direct support maintenance on steam locomotives.

(2) *Assignment.* To a transportation railway battalion or comparable unit.

(3) *Capabilities.*

(a) Performing direct support maintenance for seven steam locomotives.

(b) Adaptable to type B organization.

(4) *Basis of allocation.* One per seven steam locomotives for which the US Army has direct support maintenance responsibility.

(5) *Mobility.* Fixed.

g. Team EG, Diesel-Electric Locomotive Maintenance Detachment (Direct Support).

(1) *Mission.* To perform direct support maintenance on diesel-electric locomotive.

(2) *Assignment.* To a transportation railway battalion or comparable unit.

(3) *Capabilities.*

(a) Performing direct support maintenance for seven diesel-electric locomotives and 50 railway cars at a small terminal.

(b) Augmenting a transportation railway battalion.

(4) *Basis of allocation.* One per seven diesel-electric locomotives and 50 railway cars requiring direct support maintenance when direct support maintenance requirements for diesel-electric

locomotives exceed the capabilities of a transportation railway battalion.

(5) *Mobility*. Fixed.

h. Team EH, Railway Car Repair Crew (Direct Support).

(1) *Mission*. To inspect and perform direct support maintenance on railway cars at points distant from fixed facilities.

(2) *Assignment*. To a transportation railway battalion or comparable unit.

(3) *Capabilities*.

(a) Inspecting and performing direct support maintenance on 300 to 350 railway cars.

(b) Augmenting a transportation railway battalion.

(c) With augmentation by ambulance train maintenance team, capable of performing direct support maintenance on ambulance trains.

(d) Adaptable to a type B organization.

(4) *Basis of allocation*. One per 300 to 350 railway cars for which inspection and maintenance are required beyond the capabilities of other railway maintenance units.

(5) *Mobility*. Fixed.

i. Team EI, Railway Yard Operating Detachment.

(1) *Mission*. To operate a railroad yard.

(2) *Assignment*. To a transportation railway battalion or comparable unit.

(3) *Capabilities*.

(a) Operating a railroad yard on a 24-hour basis when yard crews are provided and when not more than two receiving and classification yards, including humps, are to be operated.

(b) Inspecting and performing running repairs on rolling stock transiting the yard.

(c) Inspecting and, as necessary, adjusting or securing loads on cars passing through the yard.

(d) Augmenting a transportation railway battalion.

(4) *Basis of allocation*. One per railroad yard of 500-cars-per-day capacity when the number of such yards to be operated exceeds the capabilities of a transportation railway battalion.

(5) *Mobility*. Fixed.

j. Team EJ, Bridge and Building Maintenance Detachment (Direct Support).

(1) *Mission*. To maintain railway bridges and buildings.

(2) *Assignment*. To a transportation railway battalion or comparable unit.

(3) *Capabilities*.

(a) Maintaining bridges and buildings along 45 to 75 track miles (72 to 121 kilometers).

(b) Adaptable to type B organization.

(4) *Basis of allocation*. As required in consonance with stated capability.

(5) *Mobility*. Fifty percent mobile by organic vehicles and rail equipment.

k. Team EK, Railway Train Operating Section.

(1) *Mission*. To operate trains.

(2) *Assignment*. To a transportation railway battalion or comparable unit.

(3) *Capabilities*. Operating three trains on a 24-hour basis in road service, or operating three trains on a 24-hour basis in switching service, when augmented by nine additional brakemen, team EN.

(4) *Basis of allocation*. As required in consonance with stated capability.

(5) *Mobility*. Fixed.

l. Team EL, Railway Workshop (Mobile) Detachment (Direct Support).

(1) *Mission*. To perform direct support maintenance of diesel-electric locomotives and rolling stock in areas where static facilities are inadequate or nonexistent.

(2) *Assignment*. To a headquarters and headquarters company, transportation railway group, or to a transportation railway battalion or comparable unit.

(3) *Capabilities*. Performing the following functions on a 24-hour daily basis:

(a) Inspecting and performing direct support maintenance on 20 diesel-electric locomotives and 100 railway cars.

(b) Assembling railway equipment.

(c) This team is adaptable to type B organization.

(4) *Basis of allocation*. One per transportation railway battalion or as required.

(5) *Mobility*. One hundred percent mobile when equipment is mounted on railroad cars.

m. Team EM, Railway Maintenance-of-Way Crew.

(1) *Mission*. To perform maintenance-of-way functions.

(2) *Assignment.* To a transportation railway battalion or comparable unit.

(3) *Capabilities.*

(a) Maintaining approximately 40 track miles (64 kilometers) (including track, bridges, buildings, and railway signals and communications lines) in a large terminal area.

(b) Adaptable to type B organization.

(4) *Basis of allocation.* As required in consonance with stated capability.

(5) *Mobility.* Fifty percent mobile by organic vehicles and rail equipment.

n. *Team EN, Railway Train Operating Section (Augmentation).*

(1) *Mission.* To augment railway train operating section, team EK, when required to operate three trains on a 24-hour basis in switching service.

(2) *Assignment.* To a railway train operating section, team EK.

(3) *Capability.* Providing brakemen necessary for operating three trains in switching service.

(4) *Basis of allocation.* One per three trains in switching service.

(5) *Mobility.* Fixed.

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CHAPTER 3

RAILWAY OPERATIONS

(NATO STANAG 2079, 2153, 2156, 2158, 2165, 2171, 2172, 2805-E (ANNEX B); CENTO STANAG 2079, 2153, 2156, 2158; SEATO SEASTAG 2079)

3-1. Establishment of Rail Operations

The normal procedure for the establishment of a railway operation in a theater of operations is set forth in *a* through *e* below. Since establishment of operations is dependent upon the rehabilitation of the railway net, the following steps may be accomplished simultaneously. After railway personnel and equipment arrive in an area, limited railway operations may be established within a few hours.

a. All rail lines, facilities, and equipment are reconnoitered by a team of railway and engineer personnel. This reconnaissance must produce sufficient intelligence of the rail line, the condition of existing facilities and equipment, and the availability of civilian railway personnel on which to base requirements for personnel and equipment for operation of the rail system.

b. The capabilities and limitations of the rail line are evaluated.

c. Subordinate rail units are oriented concerning the characteristics of the rail lines and the type of operation planned.

d. Subordinate rail units are deployed throughout the rail net.

e. Rail operations are initiated.

3-2. Methods of Operation

a. Existing railway facilities in a theater will be operated as required to support military operations. It may be expected that communications and railway signal facilities, to include any form of centralized traffic control, electrically operated interlocking plants, and automatic block signal systems, will be damaged, destroyed, or inoperative. The introduction of US radio-equipped locomotives will assist greatly in rail operations before the restoration of damaged or destroyed signal communications.

b. The methods by which trains are operated in a theater include fleet, block (positive or permissive), train order, and timetable operations or a combination of these methods.

(1) Fleet operation entails forward movement of loaded trains only during a given period (4, 8, 12, or 24 hours) and return movement of empty trains only during a succeeding like period over the same track or route. Fleet operation also may entail the movement of loaded trains over one route and the return of empty trains over another route.

(2) Block operation may be positive or permissive. In positive block operation, a train may not enter a block that already is occupied by another train. In permissive block operation, more than one train proceeding in the same direction may occupy a block at the same time.

(3) Train order operation is employed when communications are adequate and dependable and sufficient sidings and passing tracks are available. In train order operation, the dispatcher controls movements by issuing train orders.

(4) Timetable operation is employed when rail traffic in a theater becomes generally stabilized. The timetable is the authority for movement of regular trains subject to the rules. It contains the schedules of regular trains with special instructions relating thereto.

3-3. Operating and Safety Rules

a. Operating Rules.

(1) Train operations are governed by current railway operating technical manuals based on the Standard Code of Train Rules issued by the Association of American Railroads (TM 55-200). The rules will be modified to apply to conditions in a theater of operations.

(2) Correct interpretation, proper application, and observance of these operating rules

are of primary importance in efficient and safe operation of the railroad.

b. Safety Rules. Safety rules applicable to transportation railway service (TRS) personnel in the performance of duties are also published in TM 55-200. Every member of the TRS is required to familiarize himself with these rules and to obey them.

3-4. General Types of Trains

The two general types of trains that normally are operated are classified by the nature of their cargo and in some instances by their equipment:

a. Passenger trains move personnel, mail, and express on through (long) or local runs.

b. Freight trains operate as long-haul freight carriers, local freight carriers, or work trains.

3-5. Operation of Ambulance Trains

Ambulance trains (utility cars, ward cars, and kitchen cars) authorized by TOE 8-520 are medical property but are moved and maintained by the TRS. Schedules are prepared by the TRS to meet requirements of the theater army support command (TASCOM) medical command. Ambulance trains are stabled where they can be maintained as complete 9-car trains and where they can be best serviced and deployed by both medical facilities and the TRS. Special stabling areas, sidings, and spurs may be required. Train commanders of ambulance trains normally are officers of the Army Medical Department. Engineers, traincrews, and locomotives are provided by the TRS.

a. Priority. Ambulance trains normally take priority over all other trains except those being run under emergency conditions for the express purpose of supporting a force in actual combat.

b. Immunity. Red Cross markings, displayed in accordance with Geneva Convention agreements, afford the train immunity from enemy action. Geneva Convention agreements also specify who (normally noncombatants) may ride ambulance trains. Generally, riders are restricted to train operating crews, medical staffs, and patients.

c. Limits of Operation. Ambulance trains normally operate from a railhead or collecting point in the army area to an evacuation port or to hospitals in the rear of the army area, depending upon the theater evacuation policy and instructions of the medical regulating officer, medical

command. They may, when required, operate as far forward as the division rear.

d. Coordination. The medical command makes requests and indicates requirements for the movement of ambulance trains through the local movements officer. The locations of train stabling points are determined by coordination between the medical command and the TRS.

3-6. Speed of Train Movements

In the initial stages of an operation, trains operate at slow or moderate speeds. Safe arrival at destination is the primary consideration in railway operations. As the theater expands, as facilities and equipment are improved, and as operating personnel become familiar with the areas in which they are operating, train speeds may be increased.

3-7. Yard and Terminal Operations

In general usage, a yard is a system of tracks used in breaking up trains, classifying and storing cars, and making up trains. Yards are located at ports, interchange points, large depots, and forward railheads. A rail terminal includes, in addition to yard tracks, facilities for repair and service and for accommodation of railway crews. Terminals are located at train originating and terminating points and at sites which mark the limits of the operating divisions. They may consist of one or more yards.

a. When only one yard is available to receive trains and classify cars, it is designated as a combination yard. In a combination yard, trains are received, cars are classified, and made-up trains depart from the single yard or terminal facility. One disadvantage of the combination yard is that the minute-to-minute operation prevents specific track assignments before arrival of an inbound train.

b. When a terminal consists of more than one yard, functions generally are divided as follows:

(1) The receiving or inbound yard clears trains from the main line to avoid blocking the line.

(2) In the classification yard, trains are broken up, cars are classified according to commodity and destination, and new trains are made up.

(3) In the outbound or forwarding yard, trains are made ready for departure after being classified.

c. In addition to the yards designated in *b* above a terminal may contain the following special purpose tracks or yards:

- (1) Storage.
- (2) Coach.
- (3) Repair.
- (4) Stock.
- (5) Industrial.
- (6) Team.
- (7) Scale.
- (8) Shop.
- (9) Engine.
- (10) Caboose.

3-8. Assignment of Motive Power and Rolling Stock

a. *Road Engines.* Road engines are assigned to the transportation railway group at a ratio of approximately 40 engines per attached battalion. This number may be increased or decreased based upon the number and type of trains to be operated; the physical characteristics of the division; and the water, fuel, and servicing facilities available.

b. *Switch Engines.* Switch engines are assigned to yards and terminals according to the following general criteria:

- (1) Installations and depots—one per 67 cars dispatched and received per day.
- (2) Railheads—one per 67 cars dispatched and received per day.
- (3) Intermediate yards and handling terminals—one per 100 cars passing or handled per day.

c. *Rolling Stock.* Rolling stock is assigned to the transportation railway groups and will be used over the entire system. Work equipment may be assigned to transportation railway battalions as required for use on their divisions.

3-9. Interruptions to Rail Traffic

a. The TRS is responsible for clearing all interruptions to rail traffic as quickly as possible. Assistance, as required, may be obtained from the engineer command, communications-personnel, and local civilians. Major interruptions to rail traffic must be reported immediately to the commander, transportation railway group or brigade, so that required adjustments may be made in the traffic flow.

b. Major causes of rail traffic interruptions are as follows:

- (1) Enemy action, including aerial bombing and artillery fire utilizing either conventional or nuclear weapons, and guerrilla activity.
- (2) Human failure, including improper train operation, violation of rules, and improper inspection and maintenance of equipment.
- (3) Equipment or facility failure due to unforeseen or unpredictable equipment faults or defects.
- (4) Natural causes, including floods, slides, washouts, lightning fires, etc.

c. Types of interruptions are indicated by their major cause and derivatives thereof and include, but are not limited to, major derailments, minor derailments, washouts, floods, slides, tunnel cave-ins, and guerrilla action.

3-10. Use of Equipment

a. Effective and adequate transportation railway support of military operations in a theater requires efficient use of railway rolling stock and motive power. Misuse of rail equipment and facilities by shipping activities will be reported by the trainmaster to commanders responsible for loading and unloading cars, who must supervise closely to ensure that railway rolling stock is properly loaded and/or unloaded and is promptly released to the TRS.

b. Passenger equipment frequently is limited to use in troop movements, leave trains, military casual personnel trains, and ambulance trains.

c. Special equipment includes not only specially designed rolling stock for handling unusual cargo, but also railway work equipment and ambulance cars. If standard Department of the Army ambulance cars are not provided in a theater of operations, passenger equipment may be converted to ambulance cars.

d. When volume permits, containers and refrigerator or tank cars are handled in solid trains and given a high movement priority from origin to destination and return.

e. The increased use of containers for the movement of military cargo provides a throughput service to the consignee. Containers so shipped must receive a high movement priority from origin to destination consignee.

f. When trains are exposed to enemy ground or air attack, engines and cars should be modified to

provide for increased armored protection of cargo, passengers, and security elements. Armored trains may be specifically created for use by security forces in support of operations in contested areas of the railway route. Chapter 7, FM 19-30, provides a detailed description of equipment utilization under hostile conditions.

3-11. Operational Control by Higher Headquarters

a. The transportation command exercises control over the movement by rail of troops and supplies within the theater of operations.

b. The transportation command exercises control over the allocation and utilization of rail equipment used in the movement of troops and supplies within the theater of operations.

3-12. Personnel Movements (STANAG 2158)

a. *General.* Programed and unprogramed troop movements generally create a heavy demand for rolling stock; therefore, sufficient leadtime should be allowed to the railway service to permit ordering and assembling equipment for such operations. Normally, troop movements are made from selected entraining areas, generally in the vicinity of a troop staging or training area, to prevent congestion of rail facilities required for supply movements. When troop movements are made in freight equipment and long distances are involved, arrangements are made through the local transportation movements office (FM 55-11) to select and schedule stopover points en route for messing and relief of troops. For large troop moves, movement personnel schedule the departure over several days when possible. This minimizes requirements for concentration of troops and equipment and permits reuse of the same railway equipment in a shuttle movement.

b. *Authorization for Rail Travel.* Normally, the movement control center receives information on troop arrivals in the theater and on intra-theater troop movements. Based on priorities established by the theater commander, the movement control center prepares a troop movement program for issue by the TASCOM commander. This program is a directive for the accomplishment of troop movements during a specific time period and includes directives for the rail portion of the movement program.

c. *Troop Movement Procedures.* The normal procedure for troop movement by rail is as follows:

(1) Orders directing the movement are delivered to the local transportation movements officer by the commander of the unit directed to move.

(2) The local transportation movements officer obtains the following information from the commander and transmits it by the most expeditious means available to the passenger branch, movement control center, which contacts the appropriate rail unit.

(a) Authority for the move.

(b) Number of personnel.

(c) Point of origin.

(d) Destination.

(e) Date of departure or date due at destination.

(f) Quantity of baggage and/or unit equipment.

(3) Based on the above information, the railway service provides the movement control center with the following information:

(a) Route.

(b) Schedule.

(c) Type and quantity of rail equipment to be provided.

(d) Time and place of entraining.

(e) Transfer points, if required.

(f) Time and place of detraining.

(g) Rest stops, if required.

(4) The movement control center assigns a military authorization identification number (international code number, as shown in STANAG 2158, app J), to identify the movement and transmits, through movement control channels, details of the itinerary to the unit being moved.

(5) The appropriate railway unit transmits details of the itinerary to all TRS activities concerned and insures that rail equipment is made available when required and that trains are operated as scheduled.

3-13. Supply Movements (STANAG 2158)

a. Movement Documentation.

(1) *Transportation movement program.* The authority for movement of supplies by rail is contained in the transportation movement program, which also provides the authority for shippers to request transportation from the local transportation movements officer. The movement program is a directive, normally prepared by the TASCOM movement control center and issued in the name of the TASCOM commander, for the accomplishment of movements during a specific time period. This program provides the means

by which shippers, receivers, and transport services are advised of movement priorities, designated transport modes, and schedule of movements. It enables them to prepare to carry out shipments at the time and in the order specified.

(2) *Materiel release order.* The materiel management center normally issues a materiel release order (MRO) to shippers concerned with movements, with a copy furnished to the movement control center by computer-to-computer link. It assists personnel by providing information not contained in the movement program or by clarifying information included in the program. The shipping activity in requesting an MRO will furnish essentially the following information to the movements management center:

(a) Consignor and actual location of freight.

(b) Consignee and actual delivery point.

(c) Name of person requesting move.

(d) Commodity(ies).

(e) Time and date delivery is required.

(f) Total weight and cube (gallons for bulk POL) of shipment.

(g) Dimensions of items of freight over 8 feet wide, 7 feet 10 inches high, and 25 feet long.

(h) Weight of each piece over 5,000 pounds (except towed equipment). The movements management center (MMC) will determine the most efficient mode/means of transport, considering availability of equipment, priorities, and assign the MRO. The MRO will be the shipping activity's authority to request transportation equipment from the mode operator. This provides all concerned with a basic guide of essential elements of information required by the MMC for issuance of the MRO. It is based on the MRO procedure used in Japan for nearly 20 years.

(3) *Transportation movement release.* This is the release issued by the movement control organization to identify a particular shipment. It normally is issued after the consignor has requested transport and the capability of the transport mode to move the shipment has been determined.

(a) Transportation movement releases are issued on all release-unit shipments; these are shipments which, by command criteria, must be offered to the movements management organization for shipment. Normally, a release-unit shipment is one that is either over a specific weight or that occupies the total visible capacity of the transport mode carrier, or any shipment that is outsize or overweight.

(b) Shipments of less than release-unit criteria may either be consolidated by the shipper to meet release-unit criteria or, if there is insufficient material for a single destination to meet such criteria, it may be offered to the nearest transportation consolidation and distribution point for movement (FM 55-11, FM 55-1).

(c) Transportation movement releases are issued for both programed and unprogramed shipments.

(4) *Military authorization identification number.* Military authorization identification numbers are assigned to groups of 15 or more persons moving in railway passenger or mixed train service. When camp equipage, emergency ammunition, or other property of military agencies generally known as impedimenta is moved by rail, it is assigned the symbol MI (military impedimenta).

b. Ordering Rail Transport.

(1) Shipping agencies place their requirements for rail transport through their local transportation movements officer or, when authorized, through the local railway operating representative (normally collocated) a minimum of 24 hours before loading time. This affords a more economical use of switch engines and rolling stock in the car-spotting and switching operations involved.

(2) For requirements placed by the medical regulation officer, medical command, for movement of ambulance trains, the 24-hour minimum time factor does not apply; however, adequate notification enables operating personnel to respond more efficiently to requirements placed on them.

c. Loading Rail Cars.

(1) The shipper must load railcars to the maximum capacity consistent with safe tonnage or with space limitations.

(2) Blocking and bracing of loads is accomplished by the shipper.

(3) Inspection of lading of open top cars for safety of movement is a responsibility of the appropriate railway unit.

(4) When loads on flatcars on gondola cars exceed the designated height and/or width limitation, special clearance must be obtained for the route of the movement.

(5) Many foreign-manufactured car designs require an equal weight distribution of the load over the car floor. When concentrated weights

(for example, armored vehicles) are loaded, the proper type of car must be ordered and the weight of the load must be distributed to comply with the rated capacity of the car.

3-14. Containers

Containerization is a general term used to describe the transportation of goods, whether manufactured or bulk, in specially designed containers so that small packages or loose products are confined into a unitized mass to facilitate handling by an individual or a group of individuals using mechanical devices. Containerization is designed to reduce the heavy costs of manhandling goods in movement from source to user and also to minimize damage and loss due to pilferage. There are various types of containers that transport modes will be required to handle.

a. The most common type of demountable container used in rail transportation is essentially the van portion of a highway trailer that has been separated from its chassis and wheels. Demountable containers are built in a number of sizes, most often 8 feet wide, 8 or 8 1/2 feet high, and of various lengths: 6 2/3, 10, 20, 24, 30, 35, and 40 feet. Gross weights vary from 15,000 pounds for a 6 2/3-foot container to 67,000 pounds for a 40-foot container. Containers come in a variety of configurations such as, open top, tank, etc. They may be fitted with refrigeration or

atmospheric control equipment. They are carried on ships in container cells, on deck, or in the squares of hatches and are loaded and discharged using heavy lift booms or special pier or ship cranes. When unloaded from the ship, the container can be placed on a chassis, on railcars, or handled by special handling equipment. Containers which are 20 feet long or less can often be coupled on a single chassis for highway movement or in multiples on railcars. Normally, 20 cars or more will move as solid trains and will be given a high priority from origin to destination and return.

b. The Army has procured a number of demountable containers which are called MILVAN. Those now on hand are 8- by 8- by 20-foot and are capable of being coupled in two's for highway transport. Many MILVAN have interior securing devices which fit them for handling ammunition and other special cargo. Plans call for the procurement of some 6 2/3-foot containers called TRICON. Other sizes may be procured if needed.

c. The Army and Air Force have a large number of CONEX (container express). These are of two sizes—type I with a bale capacity of 135 cubic feet, and type II with 295 cubic feet. CONEXes are limited to a net weight of 10,000 pounds. They are handled and transported by conventional Army equipment.

CHAPTER 4

OPERATIONAL CONSIDERATIONS IN A THEATER OF OPERATIONS

(STANAG 2153, 2158, 2171, 2172, 2805-E (ANNEX B))

4-1. General

Military forces may use all available operational railways in the theater. Since railways are extremely vulnerable to continued damage and destruction by hostile aircraft, guerrilla action, and sabotage, an adequate rail system must be planned, including alternate routes and means of bypassing obstructions, to provide a continuous service. The provisions of STANAG 2805-E, Annex B (app N), apply to railway operations in continental Western Europe.

4-2. Location

The location of existing railway lines is of great strategic importance. Main line routes, along with required yards, sidings, and short spur tracks required to connect the various installations with the main lines, are selected. Railways in the rear of the main line of resistance and parallel to it are used where possible for lateral movement of troops and supplies.

4-3. Desirable Characteristics

a. The following are important considerations when selecting railways:

- (1) Proper location of terminals, yards, and shop facilities.
- (2) Double or multiple tracks.
- (3) Seasoned roadbed, good ballast, and heavy rail.
- (4) Light grades and curvature.
- (5) Adequate yards, sidings, spurs, and other tracks.
- (6) Bridges of sufficient strength and clearance for military loads.
- (7) Tunnels of sufficient clearance for military loads.
- (8) Loading and unloading facilities where needed.

- (9) Adequate refueling points.
- (10) Adequate signal system.
- (11) Gage of track.
- (12) Length of line.

b. Adequate terminal facilities are vital. Terminal capacity may be increased by adding side tracks and vehicular roads to permit additional loading and unloading areas.

c. Maximum use of existing rail facilities and plants requires that cars be loaded and unloaded promptly.

4-4. Undesirable Characteristics

When railways are selected for military use, care must be taken to select lines that are least vulnerable to traffic interruptions. Potential bottlenecks which are vulnerable to enemy action or natural forces are—

- a. Tunnels.
- b. Long, high bridges or bridges over deep streams or valleys.
- c. Deep cuts and high fills.
- d. Limited access terminals or yards.
- e. Track located immediately adjacent to banks of streams and dry washes subject to the erosive action of flood waters.
- f. Restrictive clearance points.
- g. Tracks running through cuts where land and rock slides are common.

4-5. Facilities

a. *Loading and Unloading.*

(1) For loading and unloading supplies and equipment, railways must have facilities, such as spur, house, team, and yard tracks; platforms; end and side loading ramps; cranes; hoists; and

pumping facilities for loading and unloading liquids.

(2) Personnel, light vehicles, and light artillery may be loaded at most railway stations. Other items, such as heavy trucks or equipment, may require special loading and unloading facilities.

(3) Points selected for loading and unloading should have easy access to adjacent highways and roads.

b. Entraining or Detraining Points. The terms entraining point and detraining point are used to designate the locations at which troops are to be loaded or unloaded. If required, sidings which normally are used for the passage of trains, main lines, or any other available facilities may be used to entrain or detrain personnel. In such cases the transportation railway service (TRS) representative assumes full control of all personnel and assisted by commander(s) concerned, entrains/detrains all personnel, moving out quickly to forming area, where control of troops reverts to commander(s). This procedure is necessary for safety and expeditious movement of personnel.

4-6. Use of Existing Facilities

a. Existing trackage and facilities are used to

the fullest extent. Construction of new main track in a theater is avoided whenever possible. However, if required, new facilities are provided and existing facilities expanded to meet requirements. These facilities may include, but are not restricted to, yards, sidetracks, fuel and water stations, signal systems (including telephone, telegraph, and radio means), and enginehouses.

b. As advances are made, captured enemy rail lines are rehabilitated as required. Availability for immediate service rather than permanency is the controlling factor in the type and character of rehabilitation.

c. The following general policies govern construction or rehabilitation of facilities in the theater:

(1) *Yards and sidings.* Military necessity dictates the construction and/or rehabilitation requirement for these facilities, but existing track layouts of yards and sidings will be used as much as possible. Track surfaces, ties, and rail are accepted on a "good enough" basis when they meet the minimum requirement for safe operation.

(2) *Water and fuel stations.* Water and fuel stations consist of any suitable facilities which are available or which can be adapted or improved.

CHAPTER 5

RELATIONSHIP WITH OTHER AGENCIES

5-1. General

a. Tact and cooperation are essential in all dealings between units and personnel of the transportation railway service and using agencies or military commands. In the field, railway groups and battalions are associated more closely with the users of transportation than is the transportation command. Because of this close association, railway units are able, through advice and assistance in solving transportation problems, to make the using units more knowledgeable of transport matters, thus affording a greater use of the rail transport capability.

b. Trains are operated by the transportation railway service. Operational safety prohibits interference by other personnel.

5-2. Higher Headquarters

a. The deployment of railway group headquarters and the railway battalions will be coordinated with the assistant chief of staff, movements, theater army support command, through the transportation command.

b. The highest railway commander in the theater advises the transportation command. Based upon this advice, the transportation command commander determines the quantity of materiel and personnel to be transported by rail. The railway commander reports conditions that affect the programmed movement of supplies, operating accomplishments, supply estimates, and plans for future courses of action.

5-3. Area Commands and Support Bridges

Transportation railway units are provided direct support services, in the army area, by the support brigades of the field army support

command, and in the communications zone, by support units of the theater army support command (TASCOM) theater area command. Examples of this support include provision of clothing and rations, chemical and communications equipment, motor vehicle repair and supply, and personnel administration and accounting. Communication with support brigade and area support group (ASGP) and rear area operations center (RAOC) should be maintained on a continual basis to insure rapid response to rear area security and area damage control emergency situations (FM 31-85 and FM 54-7).

5-4. Combat Forces

The principal contact that the transportation railway service has with the combat forces is with these forces in their role as users of rail transportation. However, combat forces may be employed to provide security for trains and rail lines when requirements exceed the capability of organic, attached, and area support command units.

5-5. Other Services

The transportation railway service cooperates with and assists other services whenever possible. For instance, railway groups and battalions assist the services in locating dump and depot sites, and they locate rail sidings for hospital units to load and unload patients in order to insure adequate rail service being available. Although equipped primarily to repair standard railway equipment, the railway battalion may coordinate with other organizations in making emergency repairs to other equipment. The battalion also may assist in handling heavy lifts with its locomotive cranes.



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CHAPTER 6

RAILWAY MAINTENANCE AND SUPPLY

6-1. General

a. Transportation railway maintenance in a theater encompasses maintenance of rail lines and facilities and of locomotives and rolling stock. It ranges from rehabilitation of rail systems and major repairs on locomotives and rolling stock to minor repairs accomplished in units during daily inspections and services.

b. Transportation railway supply may be relatively complex since it may entail the support of not only standard US Army equipment, but also foreign equipment used in support of military operations.

6-2. Maintenance of Way

a. *New Construction, Rehabilitation, and Major Repairs.*

(1) Although construction and rehabilitation of railway fixed facilities are the responsibility of the engineer command, the transportation railway service (TRS) is responsible for maintaining both the right-of-way and the equipment used by railway battalions in the daily performance of their duties (TM 5-370, TM 5-627, and TM 55-204).

(2) In accordance with the overall theater plan and with instructions received through normal command channels, the transportation railway battalion makes the necessary reconnaissance and develops information for new construction and major maintenance projects. The battalion commander, the maintenance-of-way superintendent, and all railway personnel cooperate fully with the engineer command elements in all new construction and in any major maintenance projects on the military railroad. In some instances and under definite plans and arrangements, such work will be accomplished jointly by the engineer command and the TRS.

b. *Organizational and Direct Support Maintenance.*

(1) After the railway is prepared and

turned over to the TRS for operation, organizational and direct support railway maintenance to the forward limit of traffic is the responsibility of the TRS.

(2) The battalion commander has overall responsibility to insure that his division of railway is maintained properly. The maintenance-of-way superintendent, who reports to the battalion commander, is directly responsible for maintenance of track and structures, for proper supervision of all maintenance work and procedures, and for necessary inspection of track and structures on the division operated by the battalion.

c. *Maintenance Standards.* The railway division operated and maintained by a battalion may consist of a newly constructed line or one that has been rehabilitated by the engineer command and turned over to the battalion, or it may be a line that sustained little or no war damage. Military traffic will be planned and operated to permit reaching line capacity as promptly as possible; this necessitates maximum maintenance effort. Maintenance standards are specified by the engineer section of the headquarters and headquarters company of the senior railway unit. Major attention is required on tracks, bridges, and tunnels to prevent interruptions to train operations from maintenance failure.

d. *Materials.* Maintenance and emergency repair materials are stockpiled in adequate quantities at various strategic points along the rail line to be immediately available for emergencies.

e. *Roadway Maintenance.* Roadway maintenance is the work performed to keep that part of the right-of-way on which track is constructed in good condition. This includes excavations, embankments, slopes, shoulders, ditches, and diversions of streams.

f. *Track Maintenance.* Track maintenance is the work performed to maintain the track in

safe and operable condition. It includes inspection and repair to insure proper gage, alinement, drainage, and dress of the track. Constant inspection is required to locate damage resulting from hostile action or the elements.

g. Structural Maintenance.

(1) In a theater, structures essential to railway operation must be maintained in accordance with the standard of maintenance prescribed. These structures include bridges, culverts, tunnels, and fueling and watering facilities. Minimum clearances to be observed at all structures are prescribed by the Berne clearance system and other similar systems.

(2) Maintenance of structures involves maintenance of bridges including track fastenings; track alinement, gage, and surface; bridge ties, bolts, and guardrails; and bridge members such as floor stringers, beams, tie rods, and expansion bearings. Regular inspections are necessary to insure that bridges are kept in good condition at all times.

6-3. Maintenance of Motive Power and Rolling Stock

This paragraph discusses the maintenance responsibilities of the TRS in the performance of organizational and direct support maintenance on locomotives, rolling stock, and special equipment and outlines briefly the maintenance responsibilities of the materiel command of the theater army support command (TASCOM) with respect to this equipment.

a. Maintenance of Motive Power. On motive power, maintenance by the railway service includes organizational and direct support maintenance services and periodic inspections. These inspections are as listed in the current reports of inspections and repairs, including those performed daily (or per trip), at 30-day periods, quarterly, and semiannually. Annual inspections are performed by units of the materiel command of the TASCOM (TM 55-202).

b. Maintenance of Rolling Stock. The types of maintenance services performed by railway service personnel on rolling stock are as follows:

(1) *Organizational maintenance.* Organizational maintenance is performed by operating units and by car inspectors at the train originating point and at inspection points en route to insure safe movement. It includes inspection of airbrakes, running gear, flanges, and other parts and examination and lubrication of open-

type journal boxes. On ambulance trains and cars, both before train departure and enroute, ambulance train maintenance sections and crews are responsible for the following maintenance in addition to the above (TM 55-203):

(a) Stocking of other than medical supplies, such as fuel, water, ice, and electrical supplies.

(b) Connecting cars to and disconnecting cars from standby, precooling, or heating facilities at loading or unloading points.

(c) Operating and controlling heating, air-conditioning, and car lighting equipment.

(d) Replacing light bulbs and fuses.

(e) Checking batteries.

(f) Reporting all defects and failures.

(2) *Direct support maintenance.* Direct support maintenance is provided by the railway equipment maintenance company and the mobile workshop and consists of maintenance required for safe operation of freight equipment and safe and comfortable operation of passenger and hospital cars. It may or may not require that rolling stock be taken out of service.

(a) Operations that do not require removal of equipment from service and that are performed by car inspectors at the originating point of a train and at inspection points en route include the following: replacing brake-shoes; installing new airhose; adjusting brakes; applying journal brasses; repacking journal boxes; applying oil in journal boxes; and repairing draft gear, trucks, air-conditioning, heating, or lighting equipment. Any of these services may be requested by the train conductor or train commander who will report to the chief dispatcher any defects noted during running inspections, e.g., brakes cut out, journals repacked/lubricated, flat wheels, shifted loads, hot wheels, broken flanges, and car(s) set out en route as unsafe for continued operation.

(b) Operations that require removal of equipment from service for short periods and that are performed by maintenance personnel at home terminals or at maintenance facilities include changing defective wheels, journals, side frames, couplers, draft gear, and airbrake parts and repairing trucks, piping, and car bodies to include mechanical refrigerated railcars and containers. In addition, on passenger equipment and hospital cars, such service includes daily, weekly, 30-day, semiannual, and annual inspections; cleaning equipment; changing filters; deodorizing and cleaning evaporators; lubrica-

tion; repair to air-conditioning, heating, and lighting equipment; charging batteries; maintaining water systems and coolers; and repairing and replacing hardware.

(3) *General support maintenance.* General support maintenance is provided by the diesel-electric locomotive repair company and the railway car repair company of the TASCOM materiel command. In addition to supporting the maintenance overflow from direct support, general support maintenance includes heavy maintenance involving stripping, assembling, erecting, and painting railway cars and assembling and inspecting knocked-down new equipment brought into the theater.

c. *Maintenance of Special Equipment.* Maintenance of special equipment includes maintenance services and repairs performed on wreck train equipment, wreck cranes, and other cranes of the battalion; heavy roadway equipment; tools and enginehouse machinery; and other similar equipment.

d. *Maintenance of Captured Railway Equipment.* Captured railway equipment taken over for operation may have sustained extensive damage or, because of operational pressure and a shortage of supplies, may be in a poor state of repair. Transportation railway personnel insure that all equipment taken over for operation is

repaired and serviced before being placed in operation.

6-4. Railway Supply

a. Railway supplies are designated as technical supplies. Supplies required for operation and maintenance of railways are classified as follows:

- (1) Class III, operating fuels.
- (2) Class IV, roadway maintenance items.
- (3) Class VII, rolling stock end items.
- (4) Class IX, repair parts for rolling stock.

b. The railway car repair company of the supply and maintenance command may be assigned responsibility for issuing repair parts for organizational and direct support maintenance of railway equipment.

c. The supply section of the senior railway unit in the theater is responsible for all classes of supply, including end items. Supplies are obtained from the TASCOM materiel command through the appropriate depot.

d. Each railway unit is responsible for the storage of supplies issued to the unit. Normally, a railway battalion stores all materials for operation and maintenance of the one division (90 to 150 miles or 145 to 241 kilometers of main line) it is operating.



CHAPTER 7

RAILWAY CONSTRUCTION AND REHABILITATION

7-1. General

Although construction of new main track in a theater of operations is unusual, new construction may be required when rail facilities are nonexistent or inadequate. Since railway construction and/or rehabilitation are functions of the engineer command (theater army support command), transportation basic planning principles applicable to railway construction and rehabilitation are described in this chapter.

7-2. Responsibilities of the Engineer Command

a. The engineer command is responsible for construction, rehabilitation, and major maintenance of military railways. In addition, it is responsible for stockpiling material and equipment required to construct and/or rehabilitate the railway net.

b. In a theater the engineer command, when requested by the transportation command, prepares working plans and estimates and makes preliminary preparations for construction and/or rehabilitation of railways.

7-3. Responsibilities of the Railway Service

a. The senior transportation railway service (TRS) headquarters in the theater is responsible for planning and recommending to the transportation command the rail facilities that must be constructed and/or rehabilitated.

b. In a major construction or rehabilitation project, the TRS provides technical advice and assistance and cooperates closely with engineer units. In addition, when directed, the railway service aids engineer units in accomplishing their assigned tasks.

7-4. Standards for Construction and Rehabilitation

a. Urgency of the tactical situation compels construction standards to be much less exacting than for civilian railways. Safety factors will be

lower. Sharper curves and steeper grades are permitted. Width of subgrade and depth of ballast may be less than for main line civilian railways. Initially, only minimum standards for operation have to be met. Improvement beyond initial requirements will be accomplished by the railway engineering company when the situation warrants such improvements.

b. Although engineer personnel prepare detailed railway construction plans, the transportation staff planner must consider the factors outlined in the remaining paragraphs of this chapter.

7-5. Main Line

a. Main line railways are an effective and expeditious form of transport in a theater of operations. When planning for employment, rehabilitation, and extension of a main line, the staff planner must determine the following:

- (1) Purpose and capacity.
- (2) Terminal points—initial, intermediate, final.
- (3) Direction of future development.
- (4) Controlling points as determined by tactical and strategic considerations.
- (5) Gage of tracks.
- (6) Maximum permissible degree of curvature.
- (7) Maximum permissible ruling grade.
- (8) Required distance between passing sidings.

b. Of the above elements, the ruling grade is the most important factor in the selection of a railway main line route. Natural drainage lines—rivers, inland waterways, shorelines, etc.—provide the best and most regular gradients.

c. Essential requirements of a main line track are a stable, well drained, and properly ballasted roadbed; and grades, curvature, and rail weights consistent with the weight and operating char-

acteristics of available motive power and rolling stock.

7-6. Bridges and Tunnels

Construction of tunnels and long bridges should be avoided as much as possible since such construction requires large expenditures of time, material, and labor and these structures are exceedingly vulnerable to enemy action and sabotage.

a. When tunnels are required, they must have sufficient overhead and side clearance to permit the passage of the highest and widest load moving over the rail line.

b. When bridges must be constructed, stringers must be strong enough to support the heaviest load that will be transported over the rail line.

7-7. Passing Tracks

Based on the anticipated volume of traffic and train density, passing tracks must be located at intervals that will not restrict the end delivery tonnage requirement. These tracks generally are located 6 to 8 miles (10 to 13 kilometers) apart and must be long enough to contain the longest train that will be operated over the rail line. Sidings should be located so that turnouts will not be on curves and should, where possible, be parallel to the main track to facilitate signaling between head and rear members of traincrews.

7-8. Yards, Terminals, and Railheads

Since yards, terminals, and railheads are required to receive, break-up, classify, and make up trains, properly planned and located switching facilities are essential. There are many possible track arrangements. The design chosen should depend on the size and purpose of the yard and the size and topography of available sites. Terrain and traffic govern yard layouts to such an extent that there can be no standard yard, terminal, or railhead layout. In addition to facilities necessary for repair of rolling stock, adequate leading tracks must be available to permit continuous switching; most yards need only one arrangement of leading and parallel tracks.

7-9. Fuel and Water Stations

a. Fuel and water facilities should be located near the enginehouse at railway yards and/or

terminals to permit servicing locomotives with a minimum of delay.

b. When steam locomotives are used in switching service, water facilities should be located at outlying points of the classification yard. If steam locomotives are used in road service, the distance between water stations along the main line should not exceed 30 miles (48 kilometers).

c. Fuel stations should be located at yards, terminals, and railheads. When steam locomotives are used in road service, no intermediate fuel stations are provided when the division is less than 85 miles (137 kilometers) long and one is provided when the division is 85 to 150 miles (137 to 241 kilometers) long.

7-10. Construction Effort

a. Railway construction requirements in terms of material and man-hours required for construction of new rail lines are set forth in FM 101-10-1.

b. Comparison of new construction tables with rehabilitation tables in FM 101-10-1 shows the savings in material and manpower in rehabilitating rail lines rather than constructing new lines; for example, the requirement for new construction of a 100-mile (161-kilometer) division is 1,700,000 man-hours of labor and 58,000 tons of material, but rehabilitation of the same division requires only 635,200 man-hours and 26,827 tons of material.

7-11. Areas of Destruction

a. In past conflicts, railway destruction has been heaviest near ports of entry and lighter inland. Rehabilitation requirements are based on a percentage of demolition which is established by areas. Areas of destruction are defined in terms of miles based on World War II experience. Tables showing rehabilitation requirements for each of the three following areas may be found in FM 101-10-1:

(1) Inland 0 to 30 miles (48 kilometers) from the coast—area of heavy destruction.

(2) Inland 30 to 100 miles (48 to 161 kilometers)—area of moderate destruction.

(3) Inland more than 100 miles (161 kilometers)—area of light destruction.

b. Past experience indicates that bridges, yards, and terminals suffer the greatest destruction.

CHAPTER 8

RAILWAY ENGINEERING DATA

8-1. General

Existing railroad tracks and facilities in a theater of operations must be used to their fullest extent. New construction of port trackage, terminals, and other special needs of the railway service usually are all that can be undertaken in a theater of operations. Reconstruction or rehabilitation of large portions of existing railroad facilities must be anticipated following or concurrent with major advances. Good engineering judgment is necessary before and during railroad rehabilitation; therefore, some of the basic engineering data required in estimating capabilities of existing facilities are discussed in this chapter. These include curvature, gradelines, and bridge capacities.

8-2. Horizontal Curve Classification

a. Curve Classification. The alignment of a railroad consists of straight sections (tangents) connected by curved sections. The sharpness of a curve is measured in degrees, minutes, and seconds. Curves are classified as simple, compound, and reverse. A simple curve is a single arc connecting two tangents. A compound curve is formed by two simple curves of different radii, both curving in the same direction. A reverse curve consists of two curves which bend in opposite directions. Figure 8-1 illustrates these three types of curves. The design of horizontal curves is contained in TM 5-330.

b. Degree Determination (Formula). American engineers use 100 feet (30 meters) as the invariable length of a unit chord for curve computations; however, it is possible to obtain an approximate value for the radius from the following simple empirical formula:

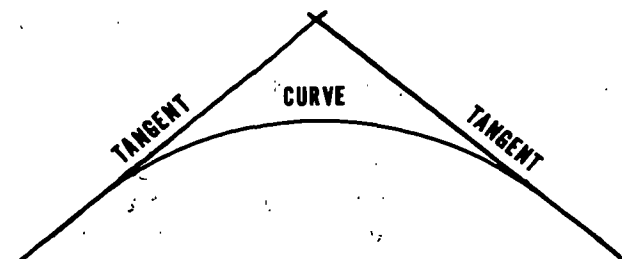
$$R \approx \frac{5,730}{D}$$

where

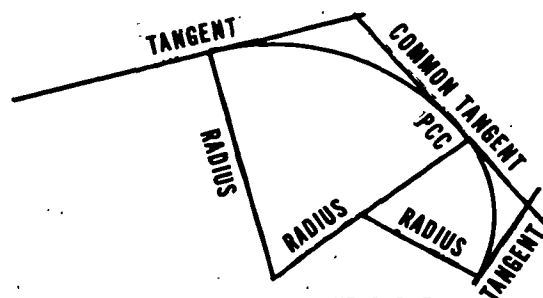
R = radius

D = degree of curvature

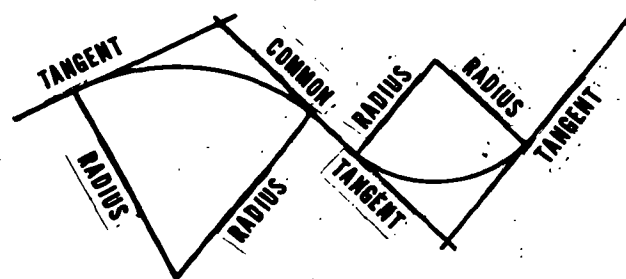
5,730 ft (1,747 m) = approximate length of radius of a 1° curve



A. SIMPLE CURVE



B. COMPOUND CURVE



C. REVERSE CURVE

Figure 8-1. Curve classification.

Likewise D can be obtained as follows:

$$D = \frac{5,730}{R}$$

c. *Degree Determination (Approximate).* The string method may be used in the field to determine the approximate degree of curvature when a surveying instrument is not available. A portion well within the main body of the curve is selected, and a chord distance of 62 feet (18.9 meters) is measured along the inside of the high rail (points A and B, fig 8-2). A string or strong cord is stretched tightly between points A and B, and the distance M is measured at the midpoint of the chord. This distance in inches is approximately equal to the degree of curvature. As a curve gets sharper, this distance increases. The normal method of horizontal curve layout for railroads uses the chord method and is contained in detail in TM 5-233.



Figure 8-2. Degree determination using the chord system.

d. *Maximum Curvature.* Although a straight line is the shortest distance between two points, if it results in too steep a grade or in numerous bridge and tunnel constructions, it is not the best location for a railroad line. Judicious and skillful use of curves offers the most satisfactory and, in many cases, the only means of locating track with grades, bridges, and tunnels held to a minimum. Table C-1 indicates the maximum curvature that locomotives used by the Department of the Army can traverse. When laying out new railroad locations, the planner should eliminate as many curves as possible,

keeping those necessary for economical construction to an absolute minimum degree of curvature.

8-3. Gradelines

a. The planner should keep gradelines to a minimum because the maximum allowable grade generally is the deciding factor in selecting alignment; it limits the load a train may move over a division or line. Gradelines are designated by the vertical change in 100 feet (30 meters). A grade rising 2 feet in a horizontal distance of 100 feet is called a +2.0 percent grade; one descending the same amount is called a -2.0 percent grade. Any grade from 0.0 percent, or level to 0.4 percent is called light; from 0.4 to 1.0 percent, moderate; from 1.0 to 2.0 percent, heavy; and above 2.0 percent, very heavy.

b. Following establishment of grade lines, the route is defined vertically in a series of straight sections (tangents) connected by smooth curve sections. The vertical curves used for the transition between straight sections are usually parabolic in form. Vertical curves are classified as overt or invert as shown in figure 8-3. Overt curves are commonly called crest curves whereas invert curves are frequently referred to as sag curves. The design and layout of each type of curve is the same and is contained in TM 5-330 for design and TM 5-233 for layout.

c. Usually, on each division or at one location on the line, a grade occurs which sets the maximum tonnage that a given locomotive can pull; this is called the ruling grade. A short, steep grade may not be the ruling grade since ton-

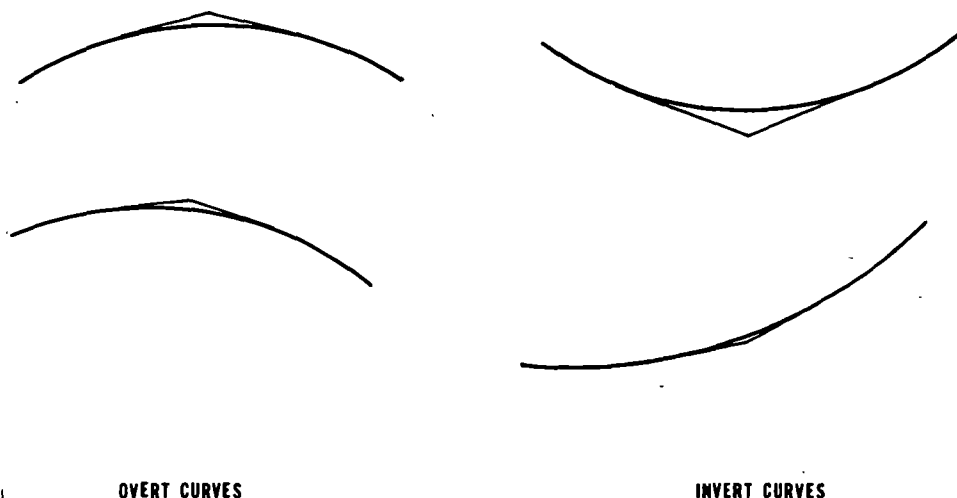


Figure 8-3. Types of vertical curves.

nage trains may be longer than the grade and may be helped over the grade by the momentum of the train without any great reduction in speed. A long grade which requires the locomotive to pull the train over the entire grade and which has a gradeline that limits the tonnage that a given locomotive can pull is classed as the ruling grade of the particular division or line.

8-4. Bridge Capacity

a. Bridge Loading. Bridges are designed to carry safely a specific concentrated load. Loads which may be placed on a structure temporarily or which may be changed in position are termed live loads to distinguish them from fixed, dead, or static loads. Live loads are the tonnage trains; static loads are the superstructure, tracks, ties, etc. The maximum line load, usually specified, consists of two coupled locomotives followed by the number of cars that occupy the entire length of the bridge. Various bridge loadings have been used, producing a great divergence in specifications and variable results. Of the innumerable loading formulas proposed, the only one which has had any standardized use is that proposed by Theodore Cooper in 1884. In this formula—known as Cooper's E rating—each driving axle on the locomotive carries a proportionate part of the total weight loaded on the drivers. The rating for a bridge to carry a 2-8-0 locomotive weighing 140,000 pounds (52,254 kilograms) on the drivers is determined as follows: A 2-8-0 locomotive has four driving axles; $140,000 \div 4 = 35,000$ pounds (52,254 kilograms $\div 4 = 13,064$ kilograms), the amount each driving axle will carry. A bridge designed to carry this locomotive safely must have a Cooper's rating of at least E-35 (the figure 35 denotes 35,000 pounds).

b. Steel and Wooden Stringer Bridges. There usually is an economical consistency in the design of all parts of a railroad bridge. Dimensions of the floor system are related to the load for which the whole structure was designed. Tables C-2 and C-3, appendix C, show the Cooper's E rating of a number of typical rail-

road bridges and the dimensions of the stringers of their floor systems.

(1) *Steel.* To estimate the capacity of a railroad bridge with steel stringers or girders as part of the floor system, the width and thickness of the lower flange of the stringer are measured (fig 8-4). The depth and the length of the stringer are also measured. The corres-

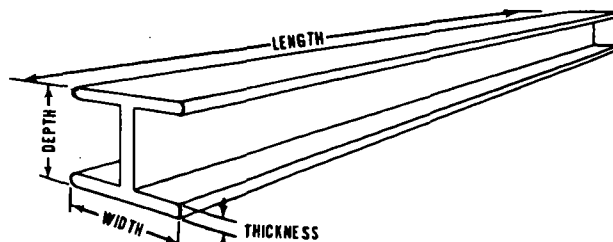


Figure 8-4. Measuring a steel stringer.

ponding E rating of the bridge is then determined from table C-2.

(2) *Wood.* To estimate the capacity of a railroad bridge with wooden stringers as part of the floor system, the width of each stringer under one track is measured. The widths of all the stringers then are added together to obtain the total (fig 8-5). The depth and length of one stringer also are measured. From table C-3, the wooden stringer is selected that most nearly approximates these dimensions and the corresponding E rating of the bridge is determined.

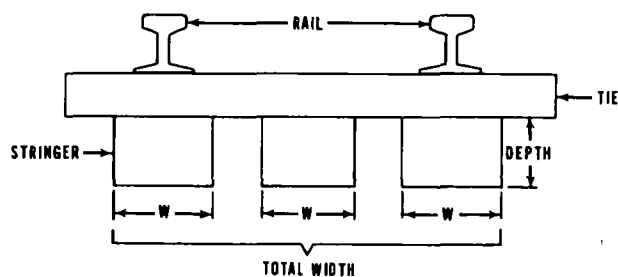


Figure 8-5. Measuring wooden stringers.

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CHAPTER 9

RAILWAY COMMUNICATIONS DATA

9-1. Communications Responsibilities

a. The Army theater communications command is responsible for reconstruction and rehabilitation of railway communications landlines. Although cable is used as the primary means of communication for train operations, radio may be employed to provide backup facilities or as a primary means when construction and/or rehabilitation of landlines are not feasible.

b. The transportation railway service is responsible for—

(1) Operation and maintenance of railway communications circuits used exclusively for operation and administration of the transportation railway system, except for maintenance of automatic data processing equipment, which is a responsibility of the theater army communications command.

(2) Installation, using table of organization and equipment (TOE) equipment of organizational communications such as local switchboards, telephones, radios, and teletypewriters in yards, way stations, shops, and dispatchers' offices for normal administrative and operational communications.

c. Installation, operation, and maintenance of organizational communications for administrative use are accomplished by the transportation railway battalion. The unit responsible for performing these functions for the battalion is the communications and railway signal maintenance platoon of the headquarters and headquarters company, transportation railway battalion.

9-2. Wire Communications System for Train Operation

The railway battalion employs wire facilities as one of its primary means of communication to dispatch trains in a theater of operations.

a. Three communications circuits are provided for operations within each railway division:

the dispatcher's circuit, the message circuit, and a teletypewriter circuit.

(1) The train dispatcher's circuit is used exclusively for the train movements by train order and for control of trains through tower-men and station agents within a division. It is a selective-ringing type voice circuit. The division dispatcher may call each way station independently or all stations simultaneously. The division dispatcher monitors the line at all times, using a loudspeaker or headset. Way station personnel may talk to the dispatcher on this circuit without signaling.

(2) The message circuit (station-to-station circuit) is used for block system operation within a division. It also is used for operational supervision and control, daily and special reports, car distribution, dissemination of movement orders to operating personnel, and operational matters between stations. This is a manual, local battery, code-ringing, party-line voice circuit. Way stations are connected to each other and to the division dispatcher. Any station may contact another station through code signaling.

(3) A teletypewriter circuit joins a division dispatcher with the adjacent division dispatcher. It is used for written transmission of train consists, operational orders, movement programs, general instructions, and miscellaneous messages. This circuit may be superimposed upon the message circuit.

b. The TOE for the headquarters and headquarters company, transportation railway battalion (TOE 55-226), provides the terminal equipment for the communications system in support of the division dispatch office and the way stations of a railway division.

c. Figure 9-1 shows a type communications system for a railway battalion operating over a track distance of 100 miles (161 kilometers).

d. Since every rail installation is different, communications systems must be planned on a project basis. This requires close coordination be-

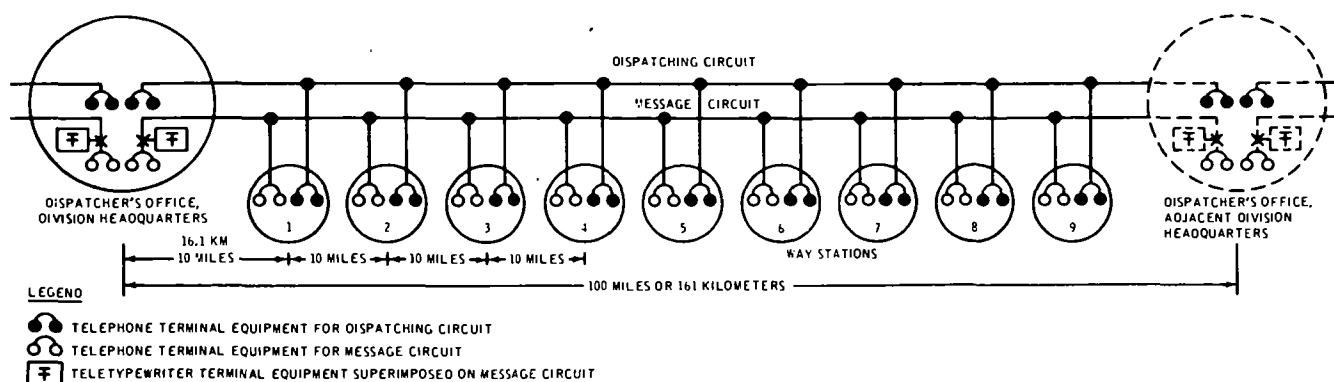


Figure 9-1. Military railway communications system.

tween the transportation and communications-electronics staff elements far enough in advance to insure that the communications-electronics officer will have the necessary personnel and material on hand when required.

9-3. Radio Communications System

Where communications landlines are inoperable, communications-electronics units, when authorized by the theater army commander, will provide radio relay or other supplementary communications as required. Teams from TOE 11-500 are attached to the railway battalion for the installation, operation, and maintenance of this system.

9-4. Organizational Radio Communications

Mobile and fixed radio communications increase efficiency, control, coordination, and safety of train movements. Radio equipment is organic to railway operating units, and its use is a normal part of rail operations. Radio communications will be employed in yard, main track, and other operations and between the locomotive and caboose of moving trains. As an insecure means of communication, radio is subject to exploitation by hostile communications intelligence and electronic warfare activities. Defense measures against such exploitation attempts, including electronic counter-countermeasures (ECCM), are discussed in FM 24-18 and FM 32-5.

a. Yard Operation. The use of radio communication in yard operation has the following advantages:

- (1) Yard crews can notify the yardmaster upon completion of assignments and receive new assignments immediately.

- (2) Delays at the interlocking plant can be eliminated by knowledge of train location.

- (3) Special movements, such as hospital trains, can be expedited.

- (4) Delays caused by derailment or damage to cars or cargo can be reported immediately.

- (5) Arrival time can be determined more accurately through communication with incoming trains.

- (6) Changes in train movements or orders can be disseminated rapidly.

b. Main Track Operation. Radio communication equipment mounted in road engines and in way stations extends communications from the way station to the moving train. This is not intended to take the place of any communications systems for which communications-electronics units are responsible on a planned project basis. Main track radio communications afford contact between trains and the dispatcher, between trains and way stations, and between stations. Use of this equipment has the following advantages:

- (1) In an emergency, the train engineer can call the way station operator and, if the train has to stop, other trains within range of the radio frequency can be advised to take necessary precautions.

- (2) Train speeds can be regulated to insure proper meetings at passing points.

- (3) Derailments can be reported immediately and repair crews can be dispatched quickly.

- (4) Crossing accidents can be reported and military police and medical assistance can be expedited.

- (5) Traincrews can request fuel or other supplies before arrival, thus reducing time at stops.

(6) The train engineer can be informed of the condition of the tracks as a result of snow and rock slides, flash floods, and bridge washouts.

(7) Guerrilla operations, sabotage attempts, and air attacks can be reported promptly by train-crews.

c. Organizational Radio Equipment. Requirements for radio communication equipment authorized by TOE are based on the fact that an average railway division is approximately 90-150 miles (145-241 kilometers) long, that it consists of approximately two large terminals or yards, and that it contains nine way stations spaced approximately 10-15 miles (16-24 kilometers) apart. In actual operations, the requirements for radio sets may vary, depending upon the tactical situation, the terrain, the facilities available, and the local circumstances.

9-5. Communications Security

a. The communications structure, usage patterns, and message traffic content associated with rail transport operations can provide enemy communications intelligence elements with valuable insights into plans and activities of friendly forces. The enemy can be expected to exploit such inter-

cepted communications for either intelligence purposes or for electronic countermeasures (ECM) (for example, jamming and deception). Distance from the forward edge of the battle area (FEBA) does not reduce this risk, since the enemy can be expected to employ airborne collection and ECM resources. Similarly, wire communications are also vulnerable to enemy exploitation through wiretapping activities.

b. Countering the threat outlined above requires judicious application of sound communications security (COMSEC) practices and procedures, and thorough training in ECCM. COMSEC reduces the amount and reliability of technical information obtainable from intercepted communications, while ECCM reduces the effectiveness of enemy ECM.

c. Details on COMSEC and ECCM are contained in FM 24-18 and FM 32-5.

d. During all phases of rail operations, constant attention must be given to operations security (OPSEC)—those actions that are necessary and appropriate to deny the enemy information concerning planned, ongoing, and completed operations. OPSEC includes COMSEC and physical security.



CHAPTER 10

RAILWAY AUTOMATIC DATA PROCESSING SYSTEM

10-1. General

If an automatic data processing system is to be used in a theater and if the system is available, it will be employed by the railway service. The type of automatic data processing system used is of small importance to the railway operators so long as it is responsive to the railroad's needs. However, the communications system must be capable of providing an uninterrupted service on a 24-hour-per-day basis. The failure of the communications system to provide this service will destroy its value for railway operations completely.

10-2. Automatic Data Processing System Requirements

a. A railway service involving operation of two railway systems will encompass over 2,000 miles (3,218 kilometers) of track. It is necessary to maintain accurate, up-to-the minute location and movement information covering over 15,000 railway cars. It also is necessary to inform shippers and receivers of the location of their consignments immediately upon receipt of their inquiries at the computer center. Combined random access to this information is required so that it will be available for repeated use, eliminating duplicate provision of source information.

b. The flow of information starts with the punching of waybill information into cards at the various points of train organization. This information then is transmitted through the data terminals to the computer, entered into the disk-pack files (giving a random access capability), and simultaneously transcribed to magnetic tape. Additional information is transmitted from the freight terminals to the computer when the train starts moving. This action will complete the information needed to answer car location inquiries.

c. The automatic data processing system also may be used in other processing functions such as—

- (1) Production of advance train consists.
- (2) Perpetual yard inventory.
- (3) Centralized freight agency accounting and cost accounting with allied nations.
- (4) Computation and development of locomotive and car statistics.
- (5) Passing reports.
- (6) Computation of right-of-way and structures statistics.
- (7) Scheduling of trains.
- (8) Routing of trains.

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CHAPTER 11

RAILWAY SECURITY

(NATO STANAG 2113, SEATO SEASTAG 2113)

11-1. General

a. In a theater, security of military and Government-sponsored supplies and equipment is of extreme importance and necessitates the use of military personnel in addition to security provided by a host government. To insure an integrated security effort, security elements attached to the transportation railway service (TRS) maintain liaison and coordination with security units having area responsibility.

b. Military action causes much destruction and confusion in cities and ports and along lines of communication. Railways are especially vulnerable in such areas. Further, military operations require logistical support that often exceeds the normal capacity of the existing ports, lines of communication, and supply support. These demands necessitate the use of temporary and improvised facilities, thus increasing the problems of safeguarding cargo, equipment, and installations against vandalism and pilferage.

c. Guerrilla activities, sabotage, and hostile air action further add to the loss of cargo and railway equipment and to the degree of vigilance required. In aggravated situations guerrilla activities may cause significant interruptions, and defense against such activities may require extensive security measures in order to continue operations.

11-2. Responsibility for Security

a. *General.* Protection of Government property is the responsibility of every officer and enlisted man in the Military Establishment. Combat and communications zone commanders are responsible for the security of their areas, including defense against enemy air or ground attack and against sabotage of lines of communication, installations, and Government property.

b. *Military Police Units.*

(1) Military police battalions, railway guard,

are in direct support of or attached to the transportation command on the basis of one battalion for each transportation railway group. Military police companies are assigned to the military police battalion on the basis of one company for each transportation railway battalion. Normally, the companies remain under command of the military police battalion and provide guard service to the railway battalion.

(2) Additional security support may be made available to the TRS by the theater army area command (TAACOM).

(3) Military police officers are provided on the staff of the senior railway service unit to advise and recommend on military police and physical security matters.

(4) Military dog teams may also be available for use in a theater of operations to augment mounted or dismounted military police patrols.

c. *Rear Area Operations Center.*

(1) The rear area operations centers (RAOC) are provided each support group and brigade within the theater of operations. The RAOC keeps the commander informed of the rear area security (RAS), the area damage control (ADC) situation in his area, and the resources available to cope with emergencies. It represents the planning capability of the commander and exercises command and control over forces designed to execute rear area protection (RAP) missions. As TRS elements will be located within or moving through RAOC areas of responsibility, TRS units will normally have communications with and maintain plans in support of RAOC activities.

(2) TRS units maintain communications with supporting RAOC through the area communications system. RAOC provides these units with current information on—

(a) Security force, artillery and aviation support.

(b) Weather, terrain, and intelligence data.

(c) Location and level of chemical, biological, or radiological contamination.

(d) ADC and explosive ordnance disposal support.

(e) Medical, emergency repair, and other support facilities.

11-3. Security of Supplies Moving by Rail

a. The TRS security responsibility for supplies, mail, and other cargo moving by rail begins when the loaded cars are accepted from the shipper and ends when these cars are delivered to the ultimate consignee.

b. An essential element in providing adequate security for railway shipments is a competent system of documentation and records; in addition, proper loading and sealing of cars and prompt loading and unloading aid materially in reducing pilferage.

c. Military police units in direct support of, or attached to, the TRS provide train guards for cars and trains en route and for cars and trains in movement in rail yards. When cars requiring repair are set out, a member of the guard crew remains with the cars to protect the cargo from pilferage until properly relieved. Guard crews check car seals and documentation and must be particularly alert for damaged or inferior cars that are subject to pilferage. Train guard reports indicate deficiencies or action taken and are used as a basis for coordinated action by the military police and the TRS.

d. FM 101-40 establishes the requirement for a technical safety escort of hazardous chemical and biological shipments. This function is performed by a munitions safety control detachment whose duties include escorting and guarding shipments in transit, protecting personnel handling the shipment, disposing of damaged munitions, and decontaminating objects and areas accidentally contaminated during shipment. Close coordination between the safety control detachment and TRS is maintained at all times.

11-4. Security of Railway Installations

Security of static installations, such as buildings, tunnels, bridges, yards, and shops, against enemy air or ground attack and sabotage must be provided for in local security and damage control plans.

11-5. Security of Trains Against Enemy Ground or Air Attack

a. *General Protective Measures.* Security measures of railroad operations are determined by the situation and area of operations. These may include—

(1) Route reconnaissance by Army aircraft.

(2) Occupation of critical terrain features.

(3) The use of special observation cars.

(4) Placement of the locomotive at the mid-section of the train to minimize damage in the event of sabotage.

(5) Use of two or three gondola cars, filled with rock, sand, or other ballast, in front of the engine to absorb mine detonation effects.

(6) Use of empty and decoy trains to precede critical shipments.

(7) Use of escort of scout trains to patrol the right-of-way.

(8) Use of special armored guard cars.

(9) Consolidation of trains to assure the most economical use of available air cover.

(10) Placing of mobile maintenance trains in strategic locations along the route or moving with trains.

(11) Movement at the highest safe speed through areas where guerrilla or partisan forces are active.

(12) Placing of security patrols along the length of the line to be traversed.

b. *Ground Attack or Guerrilla Warfare.* It may be necessary to operate and maintain rail lines in areas subject to guerrilla activity or where pockets of resistance have been bypassed during rapid advances. In such situations, any of the following actions may be necessary:

(1) Armored trains may be used to patrol in open country. Since the mission of these trains differs from that of regular trains, a dual responsibility for their operation exists: the trains operate under orders of the appropriate military commander in coordination with the TRS. The commander responsible for furnishing security provides the security personnel to man weapons and provides a striking or retaliatory force. The TRS is responsible for technical operation of the trains and provides specially selected crews to insure instant response in a tactical situation. The movement of armored trains must be coordinated with other train movements, and their movement in response to a tactical need must be facilitated.

(2) Various methods may be used to prepare cars for railway defense; among these are piling sandbags on floors and against the sides, and mounting machineguns, mortars, rocket launchers, and other weapons in the cars.

(3) The use of fixed or rotary wing aircraft for aerial reconnaissance and patrols along a rail-line provides additional security measures. These aircraft also may be employed to provide close fire support for armored trains.

(4) On a single-track rail division subject to ground attack, the positive block method of operation should be employed. In this method of operation, a following train is not permitted to enter a block until the preceding train has cleared that block. This permits the train in the block, if attacked, to back up if necessary.

(5) When a train is mined or comes under fire, the train commander immediately forwards a situation report to the nearest way station or unit. This information should be transmitted by the most expedient means available to the RAOC having responsibility for that area. RAOC response will be generated to provide assistance either through the use of combat units or RAP task forces.

(6) The primary mission of train personnel and combat or security troops is to get the train through to destination. As long as this mission is being accomplished and the train continues to move, control of the train remains with the train-crew. However, if a firefight develops and the train is unable to disengage by forward or backward movement, the senior member present takes command and undertakes defense of the train with all personnel available.

b. Enemy Air Attack.

(1) Defense against air action is conducted by security force units supporting the train. Anti-aircraft weapons are provided on cars spaced throughout the train as required.

(2) Trains that are attacked by aircraft should continue to move, if possible; however, when visibility is poor and the physical characteristics of the rail lines are favorable, it may be possible to conceal trains in tunnels, deep cuts, or heavily wooded areas.

(3) Measures taken by train operating personnel for protection against chemical agents delivered by aircraft include wearing protective clothing and masks; employing chemical agent detector kits to check locomotives, rolling stock,

and cargo transported in open cars for contamination; and performing decontamination within their capability.

11-6. Employment of Non-Air-Defense Weapons Against Aircraft

a. General. Commanders at all levels must recognize that not only do the trains, equipment, and railroad facilities of the TRS offer favorable targets for hostile aircraft, but also that there exists the threat of airmobile operations, enemy close air support, interdiction, and reconnaissance against any unit in a theater of operations. They must recognize further the potential effect of the large volume of small arms fire that can be furnished by organic weapons against low-flying aircraft and the fact that the low altitude air threat faced by units in the combat theater may be countered partially by aggressive use of the large volume of fire which non-air-defense weapons can deliver.

(1) Exercise of the individual and collective right of self-defense against hostile aircraft, which includes all attacking aircraft and those positively identified enemy aircraft that pose a threat to the unit, will be emphasized. Exercise of this right does not demand specialized use of communications and is independent of theater air defense rules for engagement and air defense control procedures.

(2) Indiscriminate use of non-air-defense weapons must be prevented because of the danger to friendly aircraft and troops and of the requirement to place in proper perspective the technique of withholding fire to preclude disclosure of position.

(3) Situations may arise where the exercise of the right of self-defense should be suppressed temporarily or where the freer use of non-air-defense weapons against aircraft should be encouraged. Since the former case involves a local decision that prevention of position disclosure is paramount, notice of such restriction is disseminated through command channels. The latter case should be based on a theater-level decision.

(4) Use of single rule for engagement, "Engage hostile aircraft," is based on the knowledge that commonsense interpretation of the rule will be correct. For example, any aircraft attacking a unit or any enemy aircraft performing operations such as forward air control, reconnaissance, surveillance, or dropping or landing troops are clearly hostile aircraft.

b. Rule for Engagement. In the absence of orders to the contrary, individual weapons operators will engage attacking aircraft; engagement of all other hostile aircraft will be on orders issued through the unit chain of command and will be supervised by unit leaders. Nothing in this rule is to be interpreted as requiring actions prejudicial to accomplishment of the primary mission of the unit.

c. Aircraft Categories. To simplify engagement procedures, aircraft are divided into two categories:

(1) *Low-speed aircraft.* This category includes helicopters and liaison, reconnaissance, and observation fixed-wing propeller aircraft.

(2) *High-speed aircraft.* This category includes all other propeller aircraft and all jet fixed-wing aircraft.

d. Techniques of Fire. The following techniques will maximize the destructive and/or deterrent effect against aircraft:

(1) *Engagement of low-speed aircraft.* In accordance with the rule for engagement, low-speed aircraft will be engaged with aimed fire, employing maximum weapon rate of fire. Aerial gunnery techniques generally applicable to all small arms and automatic weapons are contained in FM 23-65.

(2) *Engagement of high-speed aircraft.* In accordance with the rule for engagement, high-speed aircraft will be engaged with maximum fire aimed well in front of the aircraft and above its flight path to force it to fly through a pattern of fire. This technique is not unaimed barrage fire but requires a degree of aimed fire. It does not, however, call for careful estimation of aircraft speed and required lead.

(3) *Use of tracer ammunition.* Automatic weapons should use the highest practical proportion of tracer ammunition to enhance the deterrent or disruptive effect of fire.

(4) *Massed fire.* Units should employ a massed fire technique when using small arms and automatic weapons in an air defense role.

e. Standing Operating Procedures (SOP). Command and supervisory headquarters will prepare detailed SOP for identification and engagement of aircraft, to include how identification is accomplished, weapons to be employed, techniques of fire to be used, rule for engagement, and controls to be exercised. Company-level SOP will include but is not limited to—

(1) *Applicability.* The SOP applies to operators of designated weapons.

(2) *Relation to primary mission.* Primary mission is never prejudiced.

(3) *Relation to passive air defense.* The necessity for aggressively engaging hostile aircraft is balanced against the requirement to place in proper perspective the tactic of withholding fire to preclude disclosing position.

(4) *Authority to engage.* Authority to engage attacking aircraft is delegated to individual weapons operators. All other hostile aircraft are engaged on orders through unit chain of command, subject to rule for engagement and rules for withholding fire.

(5) *Rule for engagement.* Engagement normally will be in self-defense only against all attacking aircraft and those positively identified aircraft which pose a threat to the unit.

(6) *Rules for withholding fire.* Fire will be withheld when ordered, when it is not certain that aircraft actually are attacking or otherwise hostile, and when friendly aircraft or troops are endangered.

(7) *Position selection (FM 44-1).* This is applicable only to weapons specifically assigned an air-defense role; for example, designated single barrel, 50-caliber machineguns.

(8) *Firing techniques.* Firing techniques include lead and superelevation, massed fire, maximum rate of fire, and maximum use of tracer ammunition.

(9) *Unit training requirements.* Unit training includes motivation and discipline, gunnery, and aircraft recognition.

f. Individual Training. Individual training stresses aircraft recognition, techniques of firing at aerial targets, and response to control methods.

11-7. Demolition Plans

a. The extent of demolition of rail equipment and facilities is based on the commander's estimate of the situation and is of two types:

(1) Total destruction of locomotives, rolling stock, track, structures, and facilities is undertaken when the situation is such that the facilities and equipment will be of no further use and the territory being lost is not expected to be recovered for an extended period.

(2) When it is anticipated that lost territory will be regained in a relatively short time, im-

mobilization of equipment and facilities by removing and saving essential and similar parts of locomotives and rolling stock and partially demolishing selected bridges or tunnels temporarily will deny the use of tracks, equipment, and facilities to the enemy. The fact that the enemy may completely destroy the equipment and facilities upon retreat is a calculated risk which must be accepted.

b. All units of the TRS will maintain current demolition plans for each class of demolition to indicate the following:

(1) Company and unit teams responsible for implementing demolition plans.

(2) Quantities of demolition materials required and locations at which stored.

(3) Plan to implement demolition.

(4) Demolition procedures (STANAG 2113, app G).

c. Demolition and alert plans will be consolidated by the railway group or railway brigade and coordinated with the transportation commander or the commander designated to order implementation of the demolition plans.

d. Destruction of ambulance trains or cars is governed by the law of land warfare as stated in FM 27-10, which contains the provisions of the Geneva Convention of 12 August 1949.

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CHAPTER 12

PLANNING

Section I. GENERAL

12-1. Planning Considerations

The overall staff and planning functions of the transportation railway service (TRS) are the responsibility of the commander of the senior TRS unit in a theater. Planning is necessary for effective use of rail transportation facilities in any given area. For effective and efficient planning, essential information should be available concerning the basic characteristics of the line to be operated and the nature of the country in which an operation is planned. By combining this information with basic assumptions, estimates can be made of railway capacity and of requirements for personnel, supplies, and equipment needed to operate the line.

12-2. Conditions Affecting Planning

a. The TRS initially operates and uses existing rail lines, equipment, and facilities available in a theater. Only that equipment and construction material necessary to support military operations is brought into the theater to supplement existing facilities.

b. Operating conditions affecting military railways may vary widely. The problems presented by one short single-track railway will be quite different from those presented by a network of railway tracks. Therefore, instructions and information contained in this text are stated in general terms.

Section II. RAILWAY LINE CAPACITY PLANNING

12-3. General

a. Since the direction of military supply movements is primarily forward, military rail line capacity estimates generally are based on net tonnage moved in one direction. However, total capacity of a rail line is based on train density and must take into consideration movements of trains in both directions. When the railway net under consideration is composed of several divisions and branch lines, separate estimates should be made for each rail division and branch line.

b. In estimating railway line capacity in terms of payload hauled, limiting factors are the power of the locomotive and the resistances offered by the grade, the curve, the locomotive, the cars, the lading, and the weather.

c. The formulas and factors presented in the following paragraphs of this section are listed in the order in which they should be considered. Appendix B is an illustrative example giving step-by-step procedures for determining rail line capacity. Tables C-1 and C-4 through C-11, appendix C, contain many of the factors to be considered.

12-4. Weight on Drivers

Weight on drivers is expressed in short tons and is that weight which is supported by the driving wheels of a locomotive. It does not include any of the remaining portion of the locomotive's weight. The weight on drivers of some locomotives used by the Department of the Army is shown in table C-1; for those not listed in this table, specifications issued by the purchaser, the using railroad, or the manufacturer must be consulted.

12-5. Tractive Effort

Tractive effort is a measure of the potential power of a locomotive expressed in pounds; it is the horizontal force that a locomotive's wheels exert on the rails, just before the wheels will slip on the rails. A locomotive's tractive effort is included in the data supplied by the manufacturer. The tractive effort of some locomotives used by the Department of the Army is contained in table C-1. Where such data are not available, tractive effort may be determined as indicated in *a* and *b* below.

a. Starting Tractive Effort (TE).

(1) Starting tractive effort is the power that a locomotive can exert to move itself and the load that it is hauling from a dead stop. It is correlated closely to the adhesion which the driving wheels maintain at the rails. If the tractive effort expended exceeds this adhesion factor, the driving wheels will slip. Normally, the adhesion factor when the rails are dry is 30 percent of the weight on drivers; when the rails are wet, this factor is reduced to 20 percent. For planning purposes, 25 percent is used.

(2) For a diesel locomotive weighing 80 short tons (73 metric tons) or 160,000 pounds (72,574 kilograms) on the driving wheels, the starting tractive effort is computed as follows:

$$\begin{aligned} \text{TE} &= \frac{\text{Weight on drivers (lb (kg))}}{25\% \text{ adhesion factor}} \\ &= \frac{160,000 \text{ lb (72,574 kg)}}{4} \\ &= 40,000 \text{ lb (18,143 kg)} \end{aligned}$$

b. *Continuous Tractive Effort TE_c*. Continuous tractive effort is the effort required to keep a train rolling after it has been started. As the momentum of a train increases, the tractive effort necessary to keep the train moving diminishes rapidly. Since a diesel-electric locomotive cannot continue to exert the same force while pulling a load as was attained in starting that load, the continuous tractive effort of a diesel-electric locomotive is rated as approximately 50 percent of its starting tractive effort. For a diesel-electric locomotive weighing 80 short tons (73 metric tons) or 160,000 pounds (72,574 kilograms) on the driving wheels, the continuous tractive effort is computed as follows:

$$\begin{aligned} \text{TE}_c &= \frac{\text{TE}}{2} \\ &= \frac{40,000 \text{ lb (18,143 kg)}}{2} \\ &= 20,000 \text{ lb (9,071 kg)} \end{aligned}$$

12-6. Drawbar Pull (DBP)

a. Drawbar pull is the force available to pull a train after deducting from tractive effort the energy required to move the locomotive itself. In planning, 20 pounds per ton of total locomotive weight is taken from the tractive effort as follows:

$$\begin{aligned} \text{Total locomotive wt} &= 100 \text{ STON} \\ 100 \times 20 &= 2,000 \text{ pounds} \\ \text{TE minus 2,000 pounds} &= \text{DBP} \\ \text{or} \end{aligned}$$

$$\text{STE} = \frac{200,000}{4} = 50,000$$

$$\text{CTE} = \frac{50,000}{2} = 25,000$$

$$\text{DPB} = 25,000 - 2,000 = 23,000 \text{ pounds}$$

b. Maximum drawbar pull can be exerted only at lowest speeds—up to about 10 miles (16 kilometers) per hour and for a limited length of time; at higher speeds diesel-electric locomotive drawbar pull diminishes rapidly because the electric generator and traction motor cannot hold up under the heavy starting voltage and amperage, and would burn out if the load continued for a longer time after the locomotive reached a speed of 10 miles per hour. However, a steam locomotive retains its initial drawbar pull at all speeds, in the same manner that it retains its tractive effort at all speeds.

12-7. Rolling Resistance (RR)

The force components acting on a train in a direction parallel with the track which tend to hold or retard the train's movement constitute rolling resistance. The components of rolling resistance are friction between the railheads and the treads and flanges on the wheels, resistance due to undulation of track under a moving train, internal friction of rolling stock, and resistance to air. There is no absolute figure to be used as rolling resistance, but experience indicates that safe average values to use in a theater of operations for rolling resistance are as shown in table C-4.

12-8. Grade Resistance (GR)

Grade resistance is the resistance offered by a grade to the progress of a train. It is caused by the action of gravity, which tends to pull the train downhill. For military railway planning, use the factor of 20 pounds multiplied by the percentage of grade resistance in pounds per ton of trailing load (train).

12-9. Curve Resistance (CR)

Curve resistance is the resistance offered by a curve to the progress of a train. No entirely satisfactory theoretical discussion of curve resistance has been published; however, engineers in the United States usually allow from 0.8 to 1 pound per ton of train per degree of curve. In military railway planning, use the factor of 0.8 pound multiplied by the degree of curvature.

12-10. Weather Factor (W)

a. The weather factor reflects, by percentage,

the adverse effect of cold and wet weather on the hauling power of a locomotive. Experience and tests have proved that, whenever the outside temperature drops below 32° F, the hauling power of a locomotive is decreased. Table C-5 indicates the weather factor (percent) for varying degrees of temperature.

b. Ordinarily, wet weather is regarded as local and temporary and is considered absorbed by average figures. However, in countries having extended wet seasons (monsoons, fog, etc.), the loss of tractive effort due to slippery rails may prove serious if sanding facilities are lacking or inadequate. The applicable reduction is a matter of judgment, but in general, tractive effort will not be reduced to less than 20 percent of the weight on drivers.

12-11. Gross Trailing Load (GTL)

a. When diesel-electric locomotives are operated in multiple unit operation, the gross trailing load is equal to the sum of the gross trailing load for all locomotives so used. However, when the locomotives are not electrically connected for multiple unit operation, or when steam locomotives are used in tandem (doubleheaded) or in pusher service, 10 percent of the total gross trailing load is deducted because of the human element involved.

b. Gross trailing load is the maximum tonnage that a locomotive can move under given conditions; for example, curvature, grade, and weather. It is determined by combining the factors discussed in paragraphs 12-6 through 12-10. The formula for gross trailing load is as follows:

$$GTL = \frac{DBP \times W}{RR + GR + CR}$$

where—

GTL = gross trailing load
DBP = drawbar pull
W = weather resistance
RR = rolling resistance
GR = grade resistance
CR = curve resistance

c. When multiple unit diesel locomotives or pushers are used, the gross trailing load is equal to the sum of the gross trailing load for all locomotives used.

d. For foreign or captured locomotives for which little or no information is available, the gross trailing load is obtained by actual test as quickly as track and cars become available.

12-12. Net Trainload (NTL)

Net trainload is the payload carried by the train. The total weight of the cars under load is gross weight; the lightweight, or weight of the cars empty, is tare. The difference between these two is the net trainload (payload) of the train. For military railway planning purposes, the net trainload is 50 percent of the gross trailing load.

$$NTL = GTL \times .50$$

12-13. Train Density (TD)

a. General.

(1) The term train density is used to denote the number of trains that may be operated safely over a division in each direction during a 24-hour period. Work trains are not included in computing train density. However, their presence on divisions and the amount of time they block the main track can reduce the density of a rail division. Train density may vary greatly over various divisions owing to the condition and length of the main line; number and locations of passing tracks; yard and terminal facilities; train movement control facilities and procedures; and availability of traincrews, motive power, and rolling stock.

(2) On single track lines, passing tracks generally are 6 to 8 miles (10 to 13 kilometers) apart. Multiple tracks (three or more) generally are considered as double track since it often is necessary to remove a portion or all of the third and fourth tracks to maintain a double track line.

(3) The capacity or operating turnover of cars and trains into and out of terminal yards must be considered, either from definite experience and intelligence factors or by inference from related information.

(4) The rule-of-thumb and the formula given in b and c below are designed primarily to determine freight train density; however, they will be reasonably accurate on lines over which passenger trains do not exceed 20 percent of the traffic.

b. *Rule-of-Thumb for Determining Train Density.* In the absence of sufficient intelligence upon which to evaluate the potential train density of a rail line, a train density of 10 for single track and 15 for double track in each direction is used for planning.

c. *Formula for Determining Single Track*

Train Density. When sufficient intelligence is available, the following formula and factors may be used in determining train density for a specified railway division. In determining the number of passing tracks, those less than 5 miles (8 kilometers) apart should not be included. Passing tracks selected generally should be uniformly spaced throughout the division.

$$TD = \frac{NT + 1}{2} \times \frac{24 \times S}{LD}$$

where—

TD = train density

NT = number of passing tracks

1 = constant (number of trains that could be run if there were no passing tracks)

2 = constant to convert to one direction

24 = constant (number of hours per day)

S = average speed (table C-6)

LD = length of division

When the computation for train density results in a fraction, the result is raised to the next higher whole number.

12-14. Net Division Tonnage (NDT)

Net division tonnage is the tonnage in short tons or payload, which can be moved over a railway division each day. It includes railway operating supplies, which must be programed for movement the same as any other supplies. Net division tonnage is determined by multiplying the net trainload by the train density of the particular division:

$$NDT = NTL \times TD$$

Net division tonnage is computed separately for each division.

12-15. End Delivery Tonnage (EDT)

In military operations, the end delivery tonnage is the through tonnage, in short tons, of payload that may be delivered at the end of the railway line (railhead) each day. In an all-rail movement, the end delivery tonnage is the same as the net division tonnage of the most restrictive division.

$$EDT = NDT \text{ of most restrictive division}$$

Section III. RAILWAY YARD CAPACITY DETERMINATION

12-16. General

a. Railway yards, like other component elements of a railway, are designed to meet the requirements of normal operations of the area they serve. However, they may be required, within reasonable limits, to handle a traffic load varying from average peacetime traffic to peak wartime traffic requirements, but efficiency of operation may decrease when the traffic exceeds the efficient operational capacity of the yards.

b. Railway yard operational capacity has a definite relation to the number of trains that can be forwarded to or received from the main lines. Thus, although the potential train density of a main line may be 30 trains per day, the actual or operating train density may be less because of limitations of the yards.

c. Railway terminals may include the following:

- (1) Receiving yards.
- (2) Classification yards.
- (3) Forwarding yards.

(4) Other yards such as holding, repair, interchange, and storage yards.

d. In railway operations, during peak traffic

requirements, the classification yard is most likely to become the bottleneck since there are many variables which will affect the number of cars per hour that may be switched.

e. See paragraph 3-7 for additional information on types of yards.

12-17. Planning Factors for Classification Yards

The factors listed below are based on day and night operation and may be used for planning purposes. Where two or more main line railways intersect at a major terminal, the facilities will have to be duplicated accordingly.

a. Flat switching capacity is 30 cars per locomotive per hour. This includes time for switch engines to push cars into the yard (based on foreign equipment).

b. Hump switching capacity is 45 cars per locomotive per hour.

c. The number of cars in a classification yard at any given time should not exceed 60 percent of the yard's capacity. When it exceeds this figure, switching room lessens and operating efficiency is sacrificed.

d. A typical breakdown of classification tracks required for loaded cars could be as follows: two each for class I, II, III, IV, V, VI, VII, IX, and X supplies; one for class VIII supplies; and two for empties. In heavy traffic areas, an additional track factor of 25 percent may be added for rotation.

e. Length of track in a classification yard generally is one train length, plus 20 percent, plus 300 feet (91 meters). The length of tracks and/or trains varies with local terrain characteristics, railway equipment, and requirements.

f. The number of switch engines per shift that may be employed in the operation of the loaded freight classification yard may vary from one to three, depending on the yard layout. Thus, one switch engine may handle 30 to 60 cars per hour and three switch engines may handle 90 to 180 cars per hour.

(1) The breakdown of functions would be as follows:

(a) One switch engine at the head end of the receiving yard preparing cut of cars for switching.

(b) One switch engine switching cut of cars into the classification yard.

(c) One switch engine at the opposite end of the classification yard coupling cars and making switching room.

(2) During slack traffic periods, one switch engine may be used for all the above functions.

(3) It must be understood that the switch engine requirements being discussed are for use in the classification yard proper and do not include those engaged in supporting other terminal operations.

g. The average time a car remains in the classification yard is 8 hours.

h. Classification yard traffic turns over an average of three times per day. (Some cars may be held 48 hours; others may clear in less than 8 hours.)

i. Cars should be classified by commodity—POL trains, refrigerator trains, ammunition trains, or ration trains—for one destination where possible. The movement of container-on-freight-car (COFC) and trailer-on-freight-car (TOFC) trains will be used where appropriate for the movement of all types of cargo. Where solid classified trains are not operationally feasi-

ble, the number of blocks per train should average three classes of commodities and/or destinations. When trains are built up for two or more destinations, the blocks must be in proper setoff order to prevent delay if blocks are to be set off en route.

12-18. Planning Formulas for Classification Yards

The following formulas may be used to determine classification yard requirements and capabilities:

a. *Required Length of Yard Tracks.* The length of yard tracks is determined by the following computation:

$$LT = ACT \times LC \times 1.2 + 300 \text{ ft (91 m)}$$

where—

LT = length of track

ACT = average cars per train

LC = length of car (average)

1.2 = operational factor (to allow for overall length of car coupler rather than car length)

300 ft = clearance distance at each end of track from point of switch to clearance

b. *Minimum Number of Tracks Required (NTR).* The following computation is used to determine minimum tracks required:

$$NTR = \frac{TD's}{3} \times 1.6$$

where—

NTR = number of tracks required

TD's = sum of train densities of using divisions

3 = turnover per day

1.6 = 60 percent factor of static capacity

When computing requirements for a terminal yard, the result obtained in this formula must be doubled. The formula does not apply necessarily to railheads since classification of cars is not always necessary at railheads.

c. *Static Yard Capacity.* Static yard capacity is determined as follows:

$$SYC = ACT \times NT$$

where—

SYC = static yard capacity (in cars)

ACT = average cars per train

NT = number of tracks of the length determined as in a above

Daily yard capacity is equal to 1.6 times static yard capacity. This figure takes into account that the number of cars in a yard at any given time will not exceed 60 percent of the static capacity.

12-19. Planning Factors for Terminals With and Without Receiving and Forwarding Yards

a. *With Receiving and Forwarding Yards.* Where trains are operated into and out of terminals at 48-minute intervals, there should be a minimum of six tracks plus one runaround track in both the receiving and forwarding train yards to handle empty and loaded trains. In general, the number of tracks required equals the train density divided by 5, plus 1.

$$NT = \frac{TD}{5} + 1$$

Section IV. RAILWAY EQUIPMENT REQUIREMENT

(STANAG 2805-E, ANNEX B)

12-20. General

a. Availability of equipment in liberated or occupied territory depends upon inventories, extent of destruction, condition of equipment, types of fuel and local availability, availability of repair parts, types of coupling devices, and many other such factors. Allowances for use of captured or locally available equipment should be based on judgment after evaluation of the many factors involved.

b. Technical data concerning railway equipment may be found in strategic surveys, special transportation studies based on intelligence reports, reports of governments or railways in peacetime, and sometimes in publications such as *Railway Gazette* (British) and *Railway Age* (American).

c. Equipment requirements to be considered in planning fall into three categories:

(1) Rolling stock, consisting of boxcars, gondolas, flatcars, tank cars, and refrigerator cars.

(2) Road engines, the motive power used to pull trains between terminals or division points.

(3) Switch engines, the motive power used to switch cars within yards or at division terminals.

d. Appendix B (third and fourth computa-

b. *Without Receiving and Forwarding Yards.* Normally, receiving and forwarding train yards will be in balance with classification and main line capacity. However, some railways dispense with receiving and forwarding yards and operate all trains directly into and out of classification yards. In such cases, the classification yard daily capacity is reduced by approximately 25 percent.

c. *Two-Way Tonnage Traffic in Terminals.* In large terminals where tonnage traffic is two-way, the various yards normally are designed with yards for each direction; that is, northbound receiving, classification, and forwarding yards and southbound receiving, classification, and forwarding yards.

tions) provides an illustrative example of step-by-step procedures for determining railway equipment requirements.

12-21. Rolling Stock

a. *Freight.*

(1) Requirements are computed separately for operations between major supply installations or areas on each rail system as follows:

$$\text{Total cars required} = \frac{\text{EDT (by type car)}}{\text{Avg payload for type car} \times \text{Turnaround time}} \times 1.1$$

(2) The first factor of this formula,

$$\frac{\text{EDT (by type car)}}{\text{Avg payload for type car}},$$

is obtained from that part of the computation for 1 day's dispatch (1 DD) which determines the number of cars by type required to transport all or a given portion of the end delivery tonnage (EDT) of a rail system. An illustration of the application of this factor to the above stated formula is contained in appendix B (third computation).

(3) Turnaround time is the estimated number of days required for a car to make a complete circuit of the rail system. It is the days elapsed from the time the car is placed at the point of origin for loading until it is moved to its destination, unloaded, and returned to its point of origin. Such time may be computed as

follows: 2 days at origin, 1 day at destination, and 2 days in transit (1 day forward movement, 1 day return movement) for each division or major portion thereof which the cars must traverse. This method, rather than an actual hour basis, is used to incorporate delays due to terminal and way station switching as well as in-transit rehandling of trains.

Standard gage to broad gage

US equipment	20 short tons (18.14 metric tons)
Foreign equipment	10 short tons (9.07 metric tons)

Narrow gage

US equipment	15 short tons (13.61 metric tons)
Foreign equipment	7½ short tons (6.8 metric tons)

(6) Tank car requirements are computed separately, based on bulk POL requirements, tank car capacities, and computed turnaround time.

b. Passenger. Passenger car requirements vary, depending upon troop movement policies, evacuation policies, and rest and recuperation policies. Theater passenger car requirements normally are fulfilled by acquisition of local equipment, with the exception of equipment required for hospital cars or trains.

c. Disposition of Rolling Stock. Table C-8 shows the disposition of rolling stock for the operation of a railway system.

d. 1 Day's Dispatch (1 DD). The term 1 day's dispatch is the number of cars dispatched in a day from the base of operations. For planning purposes, the number of cars dispatched from a division terminal, railhead, or other dispatch point is considered the same as the number dispatched from the base of operations. The following formula is used to determine the rolling stock for 1 day's dispatch:

$$1 \text{ DD} = \frac{\text{EDT (by type car)}}{\text{Avg payload for type car}}$$

Computations are made for each type of car to be used (boxcars, gondolas, flatcars) and the sum of the results for all the types of cars computed is 1 day's dispatch for the system (third computation, app B).

12-22. Road Engines

The number of road engines required for opera-

(4) The 1.1 factor is used to express a 10-percent reserve factor which provides for a cushion of extra cars to meet operational peaks, commitments for certain classes of cars, and bad order cars.

(5) Planning factors for net load per freight car are as follows:

tion over a given railway division may be determined by the following formula (fourth computation, app B): Road engines required =

$$TD \times \frac{RT + TT}{24} \times 2 \times 1.2$$

where—

TD = train density

RT = running time (length of division divided by average speed)

TT = terminal time (time for servicing and turning locomotive) (table C-9, app C)

24 = number of hours per day

2 = constant for two-way traffic

1.2 = constant allowing 20-percent reserve

$\frac{RT + TT}{24}$ expresses the time during a 24-hour period in which a road engine is in service; it is called the engine factor. This factor provides for motive power in which may make more than one trip per day over a short division.

12-23. Switch Engines

a. No two port, division, or terminal railheads are alike in design or operation; however, the functions of the main yards in each are essentially the same. Receiving cars from whatever sources and classifying and reassembling them for delivery or forward movement constitute the main functions of any yard. The type of motive power used for these operations is the switch engine.

b. The number of switch engines required at a terminal is based on the number of cars dispatched and received at, or passing through, the terminal per day. When the number of cars has been computed, that figure is applied to the factors contained in table C-10 (app C) to deter-

mine the number of switch engines required at each terminal.

c. When the total number of switch engines required for the railway line has been computed, 20 percent is added as a reserve to allow for maintenance, operational peaks, etc. (fourth computation, app B).

Section V. RAILWAY PERSONNEL AND UNIT REQUIREMENTS

12-24. General

a. Requirements for transportation railway service units and personnel are based upon the following factors:

(1) *Number of divisions in the system.* This provides a guide to determine the number of battalions required for operation.

(2) *Number of train operating crews required to operate road and switch engines.* This provides a guide to determine the number of train operating companies required in the system.

(3) *Maintenance requirements for right-of-way, locomotives, and rolling stock.* This provides a guide to determine the number and type of maintenance units and personnel required.

b. On the basis of these factors, unit and organization capabilities and normal employment procedures can be used to organize a command structure and to determine support requirements.

12-25. Road Crews

a. In computing the number of road crews required for each division, the total time computed includes the preparation time as follows:

(1) A 2-hour period at the originating terminal for the crew to receive orders and instructions, test the air, and check the train.

(2) Running time involved, which is computed by dividing the length of the division by the average speed of the train. If information is not available to compute the speed, the speed may be assumed to be 10 miles per hour. Normally, running time over a division will be about 12 hours.

(3) A 1-hour period at the final terminal to submit necessary reports.

b. Normally, the running time should not exceed 12 hours in order to allow sufficient time for the crews to rest. This time can be exceeded for short periods in emergencies, although experience shows that safety and efficiency decrease

when crews have to work continuous daily shifts of more than 12 hours. However, it is possible to work shifts of 16 to 18 hours, provided the crews have a sufficient period of rest before reporting for another run. Sometimes it will be necessary to designate longer hours because of the length of the division involved. In such cases, enough time off between runs should be permitted to limit the average daily shift to 12 hours.

c. The following formula may be used in determining the number of road crews needed per division (fifth computation, app B):

Number of road crews =

$$TD \times 2 \times \frac{RT + 3}{12} \times 1.25$$

where—

TD = train density

2 = factor to convert to two-way traffic

RT = running time (length of division divided by average speed)

3 = 2 hours allowed for preparation at originating terminal plus 1 hour at final terminal

12 = 12-hour shift per road crew per day

1.25 = constant factor to allow for inefficiencies

12-26. Switch Crews

To determine the number of switch crews required, the number of switch engines in use at each terminal must be known. Two crews are required per switch engine per day. The following formula may be used to determine the number of switch crews required for each terminal (do not compute crews for reserve switch engines) (fifth computation, app B):

$$\text{Number of switch crews} = SE \times 2 \times 1.25$$

where—

SE = number of switch engines

2 = two crews per engine

1.25 = constant factor to allow for inefficiencies

12-27. Railway Unit Requirements

Although guidelines are provided in unit capabilities, length of railway divisions and types of operations may vary; thus all factors of rail operations must be considered in establishing an

organizational structure. Normally, the transportation railway service is organized as illustrated in figure 1-1, and units are attached in accordance with their capabilities and functions (paras 2-4 to 2-13).

Section VI. RAILWAY SUPPLY REQUIREMENTS**12-28. General**

Generally, railway supply tonnages are quite large. Planners, when computing end delivery tonnage (EDT), should be sure that all concerned understand that supply tonnages must be deducted from EDT to arrive at the actual figure that will be delivered to the units at the railhead. Paragraphs 12-29 through 12-31 below demonstrate the method of arriving at specific supply requirements; namely, fuel, lubricants, and repair parts.

12-29. Fuel Consumption of Diesel-Electric Locomotives

Table C-11 (app C) contains an estimated average rate of diesel fuel oil consumption in gallons per train-mile for diesel-electric road locomotives and in gallons per hour of operation for switch engines. For planning purposes, the operation of switch engines is assumed to be 20 hours per day. The method of determining fuel oil requirements in gallons for road locomotives and switch engines is as follows:

a. Road Locomotives (Sixth Computation, App B).

(1) Multiply the train density of the first division by 2 (for two-way travel), then multiply the result by the length of the division; this result is the train-miles per day for the division.

(2) Repeat this procedure for each division of the system.

(3) Total the daily train miles for all divisions.

(4) Multiply the total daily train miles by the fuel consumption factor (table C-11, app C) to get the daily fuel requirement.

(5) Multiply the daily fuel requirement by 30 to obtain the monthly fuel requirement.

(6) Add 5 percent to this computed total to provide a reserve for contingencies.

b. Switch Engines (Sixth Computation, App B).

(1) Multiply the total number of switch engines required (do not include reserve engines) by 20 to determine the total hours per train day of operation.

(2) Multiply the total hours per train day of operation by the fuel consumption factor of the engine concerned (table C-11, app C); this result is the daily fuel requirement in gallons.

(3) Multiply the daily fuel requirement by 30 to obtain the monthly fuel requirement.

(4) Add 5 percent to this computed total to provide a reserve for contingencies. When coal is the fuel, use a reserve factor of 10 percent.

12-30. Lubricants (Sixth Computation, App B)

Lubricants must be used on all moving parts of railway tools, appliances, and machinery and on all motive power and rolling stock. However, for planning purposes only the lubricants necessary for the operation of motive power and rolling stock will be considered. Lubricating oil and grease requirements for motive power and rolling stock are based on an estimate of 1,000 pounds per month for each train moving in either direction over each division in 1 day. The following method is used to determine the amount of lubricants required:

a. Multiply the train density of the first division by 2 (for two-way travel), and multiply the result by 1,000 to find the amount in pounds of lubricants required per month for the division.

b. Repeat this procedure for each division of the system.

c. Total the pounds of lubricants for all divisions to determine the grand total in pounds required per month for the railroad.

12-31. Repair Parts (Sixth Computation, App B)

In a theater, supplies and repair parts seldom are found in the number and of the kind necessary to maintain the motive power and the rolling

stock used by the transportation railway service. For planning purposes, only the repair parts necessary for the maintenance of motive power and rolling stock are considered. An estimate of repair parts required is based on a factor of 1.5 short tons per month for each train moving in either direction over each division in 1 day. The following method is used to determine repair parts required:

a. Multiply the train density of the first divi-

sion by 2 (for two-way travel), and multiply the result by 1.5 to get the total amount in short tons of repair parts required per month for the division.

b. Repeat this procedure for each successive division of the system.

c. Total the amounts to determine the grand total of short tons required per month for the entire railroad.

APPENDIX A

REFERENCES

A-1. Field Manuals (FM)

5-34	Engineer Field Data.
5-35	Engineers' Reference and Logistical Data.
8-10	Medical Support, Theater of Operations.
11-23	US Army Strategic Communications Command (Theater).
19-30	Physical Security.
21-40	Chemical, Biological, Radiological, and Nuclear Defense.
21-41	Soldier's Handbook for Defense Against Chemical and Biological Operations and Nuclear Warfare.
23-65	Browning Machinegun, Caliber .50 HB, M2.
23-67	Machinegun, 7.62 MM-M60.
24-18	Field Radio Techniques.
24-20	Field Wire and Field Cable Techniques.
27-10	The Law of Land Warfare.
29-30	Maintenance Battalion and Company Operations in Divisions and Separate Brigades.
29-30-1	Division Maintenance Battalion.
30-5	Combat Intelligence.
30-10	Military Geographic Intelligence (Terrain).
31-23	Stability Operations, US Army Doctrine.
31-73	Advisor's Handbook of Stability Operations.
31-85	Rear Area Protection (RAP) Operations.
(C) 32-5	Signal Security (SIGSEC) (U).
41-10	Civil Affairs Operations.
44-1	US Army Air Defense Artillery Employment.
54-7	The Theater Army Support Command.
55-1	Army Transportation Services in Theaters of Operations.
55-10	Army Transportation Movements Management.
55-11	Army Movement Control Units.
55-15	Transportation Reference Data.
55-60	Army Terminal Operations.
55-70	Army Transportation Container Operations (to be published).
100-5	Operations of Army Forces in the Field.
100-10	Combat Service Support.
101-5	Staff Officer's Field Manual—Staff Organization and Procedure.
101-10-1	Staff Officer's Field Manual—Organizational, Technical, and Logistical Data.
101-10-2	Staff Officer's Field Manual—Organizational, Technical and Logistical Data; Extracts of Nondivisional Tables of Organization and Equipment.
101-40	Armed Forces Doctrine for Chemical and Biological Weapons Employment and Defense (NPW36(C)AFM 355-2/LFM 03).

A-2. Technical Manuals (TM)

3-220	Chemical, Biological, and Radiological (CBR) Decontamination.
5-233	Construction Surveying.

5-330	Planning and Design of Roads, Airbases, and Heliports in the Theater of Operations.
5-370	Railroad Construction.
5-627	Railway Track Maintenance; Repairs and Utilities.
5-700	Field Water Supply.
38-750	Army Maintenance Management Systems (TAMMS).
55-200	Railway Operating and Safety Rules.
55-202	Operation and Maintenance of Diesel-Electric Locomotives.
55-203	Maintenance of Railway Cars.
55-204	Maintenance of Railroad Way and Structures.
55-206	Railway Train Operations.
55-207	Railway Wreck Operations-Rerailment.
55-208	Railway Equipment, Characteristics and Data.
55-601	Railcar Loading Procedures.
55-604	Troop Movement Guide.

A-3. Army Regulations (AR)

55-355	Military Traffic Management Regulation.
55-650	Military Railroads.
310-3	Preparation, Coordination, and Approval—Department of the Army Publications.
310-25	Dictionary of United States Army Terms.
310-50	Authorized Abbreviations and Brevity Codes.
380-5	Department of the Army Information Security Program.
380-55	Safeguarding Defense Information in Movement of Persons and Things.
570-1	Commissioned Officer Aviator Position Criteria.
725-50	Requisitioning, Receipts, and Issue System.
746-1	Color, Marking, and Preparation of Equipment for Shipment.
750-1	Army Materiel Maintenance Concepts and Policies.

A-4. Department of the Army Pamphlets (DA Pam)

310-series	Indexes to Military Publications.
310-35	Index of International Standardization Agreements.
690-80	Use and Administration of Local Civilians in Foreign Areas During Hostilities.

A-5. Tables of Organization and Equipment (TOE)

5-305	Engineer Topographic Battalion, Army.
8-520	Ambulance Train, Rail.
8-600	Medical Department Organization Medical Command, Control, and Staff Section Teams.
11-500	Signal Service Organization.
12-67	Personnel Service Company.
14-500	Finance Service Organization.
29-500	Composite Service Organization.
30-600	Military Intelligence Organization.
55-201	Headquarters and Headquarters Company, Transportation Railway Brigade.
55-202	Headquarters and Headquarters Company, Transportation Railway Group.
55-217	Transportation Electric Power Transmission Company.
55-226	Headquarters and Headquarters Company, Transportation Railway Battalion.
55-227	Transportation Railway Engineering Company, Transportation Railway Battalion.

55-228	Transportation Railway Equipment Maintenance Company, Transportation Railway Battalion.
55-229	Transportation Train Operating Company, Transportation Railway Battalion.
55-247	Transportation Diesel-Electric Locomotive Repair Company.
55-248	Transportation Railway Car Repair Company (General Support).
55-500	Transportation Service Organization, Headquarters Units.
55-520	Transportation Railway Service Teams.

A-6. Department of the Army Form (DA Form)

2028	Recommended Changes to Publications.
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APPENDIX B

RAILWAY PLANNING EXAMPLE*

B-1. Situation

Plan for the operation of a rail system to move supplies in a theater of operations; target date for initiation of service, 1 December. All rail tonnages originating in the port will be routed to the railhead over the main line of the system illustrated in figure B-1.

Note 1. All tonnages are expressed and computed in short tons (STON).

Note 2. All computations resulting in a fraction are raised to the next higher whole number.

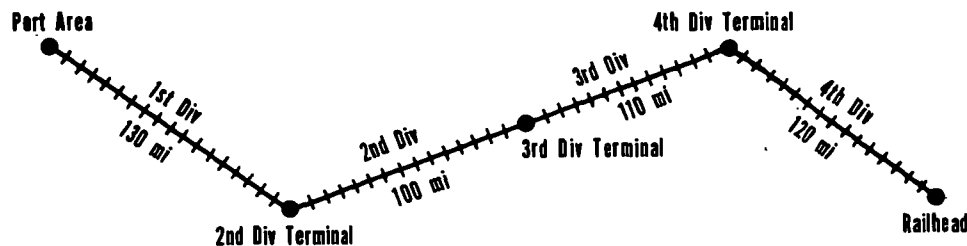


Figure B-1. Hypothetical rail system for planning.

B-2. Planning Data

a. Track.

Number	Single track
Gage	Standard (56½ inches)
Condition	All divisions—1.5%
Ruling grade	All divisions—5°
Weather	All divisions— Summer: +60° F to +95° F Winter: +35° F to -20° F Wet weather: Local and temporary
Passing tracks	1st division—15 2nd division—9 3rd division—11 4th division—14

b. Motive Power.

Road engines—US Army 0-6-6-0, 120 tons, diesel-electric locomotive.
Switch engines—US Army 0-4-4-0, 60 tons, diesel-electric locomotive.

c. Rolling Stock.

*Paragraph notations in this appendix refer to paragraphs in chapter 12 of the text.

Boxcars	40-ton rated capacity
Gondolas	40-ton rated capacity
Flatcars	50-ton rated capacity

d. Operating Personnel. US Army.

B-3. First Computation

Determine the train density (TD) for each of the four railway divisions (para 12-13c).

$$TD = \frac{NT + 1}{2} \times \frac{24 \times S}{LD}$$

$$S = 10 \text{ mph (table C-6)}$$

a. Step 1.

1st Div:

$$\begin{aligned} TD &= \frac{15 + 1}{2} \times \frac{24 \times 10}{130} \\ &= \frac{16 \times 240}{2 \times 130} \\ &= \frac{3,840}{260} \\ &= 14+ \text{ or } 15 \text{ trains} \end{aligned}$$

b. Step 2.

2nd Div:

$$\begin{aligned} TD &= \frac{9 + 1}{2} \times \frac{24 \times 10}{100} \\ &= \frac{10 \times 240}{2 \times 100} \\ &= \frac{2,400}{200} \\ &= 12 \text{ trains} \end{aligned}$$

c. Step 3.

3rd Div:

$$\begin{aligned} TD &= \frac{11 + 1}{2} \times \frac{24 \times 10}{100} \\ &= \frac{12 \times 240}{2 \times 110} \\ &= \frac{2,880}{220} \\ &= 13+ \text{ or } 14 \text{ trains} \end{aligned}$$

d. Step 4.

4th Div:

$$\begin{aligned} TD &= \frac{14 + 1}{2} \times \frac{24 \times 10}{120} \\ &= \frac{15 \times 240}{2 \times 120} \\ &= \frac{3,600}{240} \\ &= 15 \text{ trains} \end{aligned}$$

B-4. Second Computation

a. General. Determine the end delivery tonnage of this rail line, using single engine operation (winter season). To do this, the following formulas must be used:

- (1) EDT = NDT of most restrictive division (para 12-15).
- (2) NDT = NTL × TD (para 12-14).
- (3) NTL GTL × .50 (para 12-12).

$$(4) \text{ GTL} = \frac{\text{DBP} \times \text{W}}{\text{RR} + \text{GR} + \text{CR}} \quad (\text{para 12-11}).$$

$$(5) \text{ DBP} = \text{TE}_c - (\text{Total weight of engine in STON} \times 20 \text{ lb per STON}) \quad (\text{para 12-6}).$$

$$(6) \text{ TE}_c = \frac{\text{TE}}{2} \quad (\text{para 12-5b}).$$

$$(7) \text{ TE} = \frac{\text{Weight on drivers (lb)}}{25\% \text{ adhesion factor}} \quad (\text{para 12-5a}).$$

b. Step 1. Compute the starting tractive effort.

$$\begin{aligned} \text{TE} &= \frac{\text{Weight on drivers (lb)}}{4} \\ &= \frac{240,000}{4} \\ &= 60,000 \text{ lb} \end{aligned}$$

c. Step 2. Compute the continuous tractive effort.

$$\begin{aligned} \text{TE}_c &= \frac{\text{TE}}{2} \\ &= \frac{60,000}{2} \\ &= 30,000 \text{ lb} \end{aligned}$$

d. Step 3. Compute the drawbar pull of the road engine.

$$\begin{aligned} \text{DBP} &= \text{TE}_c - (\text{Total weight of engine in STON} \times 20 \text{ lb per STON}) \\ &= 30,000 - (120 \times 20) \\ &= 30,000 - 2,400 \\ &= 27,600 \text{ lb} \end{aligned}$$

e. Step 4. Compute the gross trailing load.

$$\text{GTL} = \frac{\text{DBP} \times \text{W}}{\text{RR} + \text{GR} + \text{CR}}$$

where

DBP = 27,600 lb (preceding calculation)

W = 80% (table C-5)

RR = 6 lb per STON of train (table C-4)

GR = 1.5% $\times$ 20 lb per STON of train = 30 lb per STON of train
(para 12-8)

CR = 5° $\times$ 0.8 lb per STON of train = 4 lb per STON of train
(para 12-9)

$$\begin{aligned} \text{GTL} &= \frac{27,600 \text{ lb} \times .80}{6 \text{ lb/STON} + 30 \text{ lb/STON} + 4 \text{ lb/STON}} \\ &= \frac{22,080 \text{ lb}}{40 \text{ lb/STON}} \\ &= 552 \text{ STON} \end{aligned}$$

f. Step 5. Compute the net trainload.

$$\begin{aligned} \text{NTL} &= \text{GTL} \times .50 \quad (\text{para 12-12}) \\ &= 552 \times .50 \\ &= 276 \text{ STON} \end{aligned}$$

g. Step 6. Compute the end delivery tonnage of the system by determining the net division tonnage (NDT) of the most restrictive division (para 12-14, 12-15).

$$\begin{aligned} \text{NDT} &= \text{NTL} \times \text{TD} \\ \text{1st div:} & 276 \times 15 = 4,140 \text{ STON} \\ \text{2nd div:} & 276 \times 12 = 3,312 \text{ STON} \end{aligned}$$

3rd div: $276 \times 14 = 3,864$ STON
 4th div: $276 \times 15 = 4,140$ STON
 EDT = NDT of 2nd div (most restrictive)
 EDT = 3,312 STON

B-5. Third Computation

Determine the rolling stock requirements for this rail system when operating at maximum capacity during winter months, using single engine operation. Each type of freight car will move the following percentages of the end delivery tonnage:

Boxcars	50 percent of EDT
Gondolas	25 percent of EDT
Flatcars	25 percent of EDT

a. Step 1. Compute the portion of the EDT to be moved in each type of railcar:

Boxcars: $\text{EDT} \times 50\% = 3,312 \times .50 = 1,656$ STON
 Gondolas: $\text{EDT} \times 25\% = 3,312 \times .25 = 828$ STON
 Flatcars: $\text{EDT} \times 25\% = 3,312 \times .25 = 828$ STON

b. Step 2. Compute rolling stock requirements for 1 day's dispatch (para 12-21). To do this the following formulas must be applied:

$$\text{Total cars required} = \frac{\text{EDT (by type car)}}{\text{Avg payload for type car} \times \text{Turnaround time} \times 1.1}$$

$$1 \text{ DD} = \frac{\text{EDT (by type car)}}{\text{Avg payload for type car}}$$

Note. Average payload in tons per type car = $\frac{\text{Rated capacity}}{2}$

Thus 1 day's dispatch for all types of cars is computed as follows:

Boxcars: $1 \text{ DD} = \frac{1,656}{2} = 82+ \text{ or } 83 \text{ cars}$
 Gondolas: $1 \text{ DD} = \frac{828}{20} = 41+ \text{ or } 42 \text{ cars}$
 Flatcars: $1 \text{ DD} = \frac{828}{25} = 33+ \text{ or } 34 \text{ cars}$
 Total cars in 1 DD = 159 cars

Rolling stock requirements are based on a turnaround time of 11 days as shown in figure B-2. Thus total rolling stock requirements are computed as follows:

$1 \text{ DD} \times \text{turnaround time} = \text{cars rqr} \times 1.1 \text{ (reserve factor)} = \text{total cars rqr}$

Boxcars: $83 \times 11 = 913 \times 1.1 = 1,004+ \text{ or } 1,005 \text{ cars}$
 Gondolas: $42 \times 11 = 462 \times 1.1 = 508+ \text{ or } 509 \text{ cars}$
 Flatcars: $34 \times 11 = 374 \times 1.1 = 411+ \text{ or } 412 \text{ cars}$
 Total rolling stock requirements: 1,926 cars

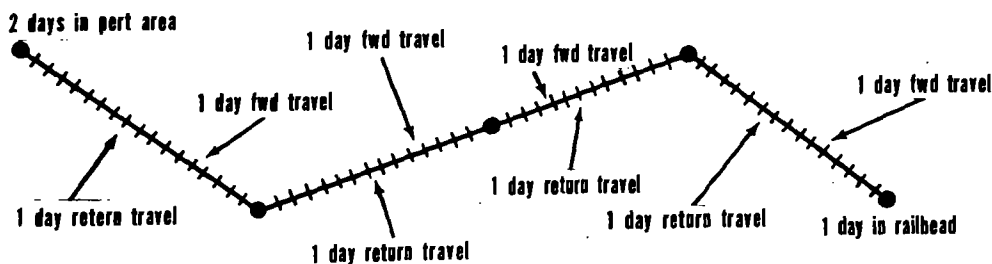


Figure B-2. Determination of turnaround time in days.

B-6. Fourth Computation

Determine the road and switch engine requirements for the operation of this system at maximum capacity during winter months, using single engine operation.

a. *Step 1.* Compute for road engines required (para 12-22).

$$\text{Number of road engines} = \text{TD} \times \frac{\text{RT} + \text{TT} \times 2 \times 1.2}{24}$$

(1) Compute for factors:

	TD	(Length of div + Avg speed)	RT	TT
				(table C-9)
1st div:	15	130 + 10 = 13		3
2nd div:	12	100 + 10 = 10		3
3rd div:	14	110 + 10 = 11		3
4th div:	15	120 + 10 = 12		3

(2) Compute requirements.

$$\text{1st div: } 15 \times \frac{13 + 3}{24} \times 2 \times 1.2 = 36 \times \frac{16}{24} = \frac{576}{24} = 24 \text{ road engines}$$

$$\text{2nd div: } 12 \times \frac{10 + 3}{24} \times 2 \times 1.2 = 28.8 \times \frac{13}{24} = \frac{374.4}{24} = 15+ \text{ or } 16 \text{ road engines}$$

$$\text{3rd div: } 15 \times \frac{11 + 3}{24} \times 2 \times 1.2 = 33.6 \times \frac{14}{24} = \frac{470.4}{24} = 19+ \text{ or } 20 \text{ road engines}$$

$$\text{4th div: } 15 \times \frac{12 + 3}{24} \times 2 \times 1.2 = 36 \times \frac{15}{24} = \frac{540}{24} = 22+ \text{ or } 23 \text{ road engines}$$

Total road engines required = 24 + 16 + 20 + 23 = 83 road engines

b. *Step 2.* Compute for switch engines (para 12-23).

	Cars dispatched and received per day	Cars passing per day	Computation factor (table C-10)	Switch engines required
Port				
terminal:	159 × 2		+ 67	= 4+ or 5
2nd Div				
terminal:		159 × 2	+ 100	= 3+ or 4
3rd Div				
terminal:		159 × 2	+ 100	= 3+ or 4
4th DIV				
terminal:		159 × 2	+ 100	= 3+ or 4
Railhead:	159 × 2		+ 67	= 4+ or 5
			Subtotal	22
			+20% reserve (4+ or 5)	5
				27

B-7. Fifth Computation

Determine the number of switch and road crews required to support this rail system.

a. *Step 1.* Compute for road crews required (para 12-25).

$$\text{Road crews} = \text{TD} \times 2 \times \frac{\text{RT} + 3}{12} \times 1.25$$

(1) Compute for factors.

	TD	RT (Length of div + Avg speed)
1st div:	15	130 + 10 = 13
2nd div:	12	100 + 10 = 10
3rd div:	14	110 + 10 = 11
4th div:	15	120 + 10 = 12

(2) Compute for road crew requirements.

$$\begin{aligned}
 \text{1st div: Road crews} &= 15 \times 2 \times \frac{13 + 3}{12} \times 1.25 \\
 &= 37.5 \times \frac{16}{12} \\
 &= \frac{600}{12} \\
 &= 50 \text{ crews}
 \end{aligned}$$

$$\begin{aligned}
 \text{2nd div: Road crews} &= 12 \times 2 \times \frac{10 + 3}{12} \times 1.25 \\
 &= 30 \times \frac{13}{12} \\
 &= \frac{390}{12} \\
 &= 32+ \text{ or } 33 \text{ crews}
 \end{aligned}$$

$$\begin{aligned}
 \text{3rd div: Road crews} &= 14 \times 2 \times \frac{11 + 3}{12} \times 1.25 \\
 &= 35 \times \frac{14}{12} \\
 &= \frac{490}{12} \\
 &= 40+ \text{ or } 41 \text{ crews}
 \end{aligned}$$

$$\begin{aligned}
 \text{4th div: Road crews} &= 15 \times 2 \times \frac{12 + 3}{12} \times 1.25 \\
 &= 37.5 \times \frac{15}{12} \\
 &= \frac{562.5}{12} \\
 &= 46+ \text{ or } 47 \text{ crews}
 \end{aligned}$$

Total road crews required = 50 + 33 + 41 + 47 = 171 road crews

b. Step 2. Compute for switch engine crews required (para 12-26).
(Do not include reserve switch engines.)

$$\text{Switch crews} = \text{SE} \times 2 \times 1.25$$

Port area:	Switch crews = 5 × 2 × 1.25 = 12+ or 13
2nd Div terminal:	Switch crews = 4 × 2 × 1.25 = 10
3rd Div terminal:	Switch crews = 4 × 2 × 1.25 = 10
4th Div terminal:	Switch crews = 4 × 2 × 1.25 = 13
Railhead	Switch crews = 5 × 2 × 1.25 = 12+ or 13
	Total switch crews required = 56

c. Step 3. Determine total number of switch and road crews required.

$$\begin{aligned}
 \text{Road crews} &= 171 \\
 \text{Switch crews} &= 56 \\
 \text{Total switch and road crews} &= \overline{227}
 \end{aligned}$$

B-8. Sixth Computation

Determine the monthly engine fuel, lubricants, and repair parts requirements for the operation of this system.

a. *Step 1.* Compute fuel requirements for road engines (para 12-29 and table C-11).

	TD	×	Two-way travel	×	LD	=	Train miles per, day
1st div:	15	×	2	×	130	=	3,900
2nd div:	12	×	2	×	100	=	2,400
3rd div:	14	×	2	×	110	=	3,080
4th div:	15	×	2	×	120	=	3,600
Total train miles per day						=	12,980

12,980 train miles per day $\times$ 2.5 gal per train mile = 32,450 gal per day
 32,450 gal per day $\times$ 30 days = 973,500 gal per month
 973,500 gal per month
 + 48,675 5% reserve
1,022,175 total gal per month

b. *Step 2.* Compute fuel requirements for switch engines (para 12-29 and table C-11). (Do not include reserve switch engines.)

No. of switch engines	×	Hrs per day opera- tion	×	Rate of fuel consumption (gal per hr per locomotive)	=	Daily require- ment (gal)
22	×	20	×	8	=	3,520

3,520 gal per day $\times$ 30 days = 105,600 gal per month
 105,600 gal per month
 + 5,280 5% reserve
110,880 gal per month

c. *Step 3.* Compute total fuel requirement.

1,022,175 road engine requirements per month in gallons
 110,880 switch engine requirements per month in gallons
1,133,055 total requirements per month in gallons

d. *Step 4.* Compute monthly lubricant requirements (para 12-30).

	TD	×	Two-way travel	×	Lubricants (lb per mo per train per day)	=	Lubricants (lb per month)
1st div:	15	×	2	×	1,000	=	30,000
2nd div:	12	×	2	×	1,000	=	24,000
3rd div:	14	×	2	×	1,000	=	28,000
4th div:	15	×	2	×	1,000	=	30,000
Total lubricants required per month						=	112,000 lb

e. *Step 5.* Compute monthly repair parts requirements in short tons (para 12-31).

	TD	x	Two-way travel	x	Repair parts (STON per mo per train per day)	=	Repair parts (STON per month)
1st div:	15	x	2	x	1.5	=	45
2nd div:	12	x	2	x	1.5	=	36
3rd div:	14	x	2	x	1.5	=	42
4th div:	15	x	2	x	1.5	=	45
Total spare parts per month =							<u>168</u> STON

APPENDIX C **STATISTICS FOR USE IN RAILWAY PLANNING**

Table C-1. Characteristics of United States Army Locomotives

Type of locomotive	Gage (inches)	Weight (pounds)	Length over couplers	Extreme width	Extreme height	Tractive force (pounds)		Horse- power	Curvature minimum radius (feet)	Fuel capacity (gallons)
						Starting at 30% adhesion	Continuous			
131-Ton, 0-6-6-0, domestic and foreign service, FSN-2210-554-0786	56½	262,900	55'	10'0"	14'0"	75,700	28,000 at 10 mph	1,000	231	1,600
127-Ton, 0-6-6-0, domestic and foreign service, FSN 2210-270-1354	56½	261,000	55'	10'0"	10'0"	75,700	28,000 at 10 mph	1,000	231	1,600
120-Ton, 0-6-6-0, domestic and foreign service, FSN 2210-814-5291 FSN 2210-815-3521-w/ generator	56½, 60, 63, 66	240,000 246,000 w/steam generator	57'5"	9'8"	13'6"	73,000	47,000 at 10 mph	1,600	193	1,600 800 w/steam generator
120-Ton, 0-6-6-0, domestic and foreign service, FSN 2210-819-9317	56½, 60, 63, 66	240,000 246,000 w/steam generator	56'9"	9'7"	13'5"	72,000	45,000 at 10 mph	1,600	193	1,600 800 w/steam generator
120-Ton, 0-4-4-0, domestic service, FSN 2210-554-0785	56½	240,000	55'9"	10'3"	14'6"	75,000	40,000 at 11 mph	1,500	150	800
120-Ton, 0-4-4-0, domestic service, FSN 2210-262-0751	56½	246,000	48'10"	10'2"	14'6"	73,000	35,000 at 10 mph	1,200	100	750
115-Ton, 0-4-4-0, domestic service, FSN 2210-112-8508	56½	230,000	45'6"	10'0"	14'6"	69,000	20,000 at 15 mph	1,000	50	635
100-Ton, 0-4-4-0, domestic service, FSN 2210-819-9320	56½	199,000	44'6"	10'0"	14'4"	59,700	18,750 at 10 mph	660	50	635
100-Ton, 0-4-4-0, domestic service, FSN 2210-371-7535	56½	200,000	44'5"	10'0"	14'7"	69,700	18,750 at 10 mph	800	100	600
80-Ton, 0-4-4-0, domestic service, FSN 2210-820-5451	56½	161,000	36'10"	9'6"	13'7"	48,000	10,000 at 10 mph	500	75	400
80-Ton, 0-4-4-0, domestic service, FSN 2210-804-3614	56½	161,000	36'10"	9'6"	13'7"	48,000	10,000 at 10 mph	470	75	400
80-Ton, 0-4-4-0, domestic service, FSN 2210-804-3615	55½	161,000	41'0"	9'6"	13'4"	48,000	21,000 at 5.2 mph	550	75	400
76-Ton, 0-6-6-0, foreign service, FSN 2210-543-3290	36, 39½, 42	156,000	41'3"	8'6"	11'3"	45,000	28,000 at 7.7 mph	975	100	

Table C-1. Characteristics of United States Army Locomotives—Continued

Type of locomotive	Gage (inches)	Weight (pounds)	Length over couplers	Extreme width	Extreme height	Tractive force (pounds)		Horse-power	Curvature minimum radius (feet)	Fuel capacity (gallons)
						Starting at 30% adhesion	Continuous			
65-Ton, 0-4-4-0, domestic service, FSN 2210-819-9319	56½	130,000	34'0"	10'1"	13'5"	39,000	9,500 at 10 mph	400	75	250
60-Ton, 0-4-4-0, domestic and foreign service, FSN 2210-819-9318	56½, 60, 63, 66	122,000	38'11" (Type E) 39'3" (Willison)	9'6"	13'4"	36,000	15,680 at 7.78 mph	500	75	500
58-Ton, 0-4-4-0, foreign service, FSN 2210-529-9037	36, 39½, 42	115,000	Length over end sills 35'0"	8'6"	11'3"	36,000	15,680 at 7.28 mph	400	75	500
45-Ton, 0-4-4-0, domestic and foreign service, FSN 2210-529-9038	56½	90,000	33'6"	9'7"	12'0"	27,000	12,000 at 6 mph	380	50	250
45-Ton, 0-4-4-0, domestic service (side rod drive) FSN 2210-821-1135	56½	90,000	28'4"	9'6"	12'0"	27,000	13,500 at 6.2 mph	300	50	165
44-Ton, 0-4-4-0, domestic service, FSN 2210-804-3610	56½	91,270	33'10"	9'4"	13'3"	26,400	11,000 at 9 mph	380	75	250
44-Ton, 0-4-4-0, domestic service FSN 2210-820-5602	56½	89,000	33'5"	10'1"	13'3"	26,400	13,000 at 7.1 mph	380	50	250
25-Ton, 0-4-0, domestic service FSN 2210-834-3202	56½	50,000	16'1"	8'7"	10'4"	15,000	6,200 at 6.2 mph	150	50	75

Note. This table shows a 30 percent adhesion factor. In planning, use a 25 percent adhesion factor to take into account inclement weather and the most restrictive factors.

Table C-1. Characteristics of United States Army Locomotives—Continued

Type of locomotive (cranes)	Gage (inches)	Weight (pounds)	Length over couplers	Extreme height	Extreme width	Boom length (feet)	Reach radius and capacity	
							Main hoist	Auxiliary hoist
Locomotive, steam, wrecking, 75-ton, broad gage, domestic and foreign service, FSN 2230-174-9138	56½, 60, 63, 66	191,000	30'10"	17'10"	10'4"	25 two-piece, curved	16' 75-ton 25' 34-ton	25' 10-ton 30' 8-ton
Locomotive, diesel-mechanical, 150-ton, domestic service, FSN 2230-554-4545	56½	291,700	3'10"	15'6"	10'4"	28 two-piece, straight	28' 67-ton 17½" 160-ton	
Locomotive, diesel-electric, 40-ton, broad gage, domestic and foreign service, FSN 2230-554-2728	56½, 60, 63, 66	221,500	36'1"	13'6"	10'4"	50 two-piece, straight	12' 40-ton 50' 6-¾-ton	
Locomotive, diesel-electric, 40-ton domestic service, FSN 2230-939-6649	56½	220,000	29'4"	15'1"	10'6"	50 two-piece, straight	12' 40-ton 50' 6-¾-ton	
Locomotive, diesel-mechanical, 25-ton, broad gage, domestic and foreign service, FSN 2230-174-9130	56½, 60, 63, 66	148,000	27'7"	13'0"	8'6"	50 two-piece, straight	12' 25-ton 50' 4-ton	

Table C-1. Characteristics of United States Army Locomotives—Continued

Type of locomotive (cranes)	Gage (inches)	Weight (pounds)	Length over couplers	Extreme height	Extreme width	Boom length (feet)	Reach radius and capacity	
							Main hoist	Auxiliary hoist
Locomotive, diesel-mechanical, 25-ton, narrow gage, foreign service, FSN 2280-202-2111	36, 39 3/4, 42	152,000	32'6"	12'0"	8'6"	40 two-piece straight	12' 25-ton 40' 6-ton	
Locomotive, diesel-mechanical, 25-ton domestic service, FSN 2230-809-9863	56 1/2	155,000	30'0"	15'2"	10'8"	50 two-piece, straight	12' 25-ton 50' 4-ton	
Locomotive, diesel-mechanical, 35-ton, domestic service, FSN 2230-803-8571	56 1/2	167,000	30'0"	15'7"	10'4"	50 two-piece straight	12' 35-ton 50' 5-ton	

Table C-1. Characteristics of United States Army Locomotives—Continued

Railway maintenance motor cars	Gage (inches)	Weight (pounds)	Length (inches)	Width (inches)	Height (inches)	Capacity	Horsepower	Fuel capacity (gallons)
Gasoline-mechanical, 4 wheels, solid drawbar couplers, closed cab with handbrake, FSN 2230-230-2765.	56 1/2	2,950	112	65	58	8-man excluding cab	62.6	8
Gasoline-mechanical, 4 wheels, solid drawbar couplers, open body with handbrake, FSN 2230-926-1053.	56 1/2	1,700	103	65	50	10-man	62.6	8

Table C-2. Bridge Capacities Expressed in Cooper's E Rating as Reflected in the Dimensions of Stringers

Lower flange			Span length (ft)															
Thickness (in.)	Width (in.)	Stringer depth (in.)	10	11	12	18	14	15	16	17	18	19	20	22	24	26		
3/8	8 3/8	18	E-42	E-41	E-41	E-41	E-35	E-31	E-27									
3/8	10 3/8	24		E-59	E-48	E-40	E-59	E-51	E-46	E-41	E-37	E-33	E-30	E-27	E-48	E-43		
1/2	10 3/8	30				E-61												
1/2	12 1/2	30						E-62	E-56	E-50	E-45	E-41	E-37	E-31	E-39	E-34		
1	14	36								E-60	E-58	E-55	E-54	E-51				
1 1/2	12 3/8	42										E-60	E-54	E-45				
1 1/2	14	42											E-63	E-60	E-57	E-54		

Table C-2. Bridge Capacities Expressed in Cooper's E Rating as Reflected in the Dimensions of Stringers—Continued

Lower flange			Span length (ft)															
Thickness (in.)	Width (in.)	Stringer depth (in.)	28	30	35	40	44	50	54	60	64	70	74	80	84	90		
1	14	42	E-39	E-34	E-26													
1 1/2	12 3/8	42	E-30	E-26														
1 1/2	14	42	E-51	E-45														
1 1/2	16	42	E-60	E-54	E-42	E-32												
1 1/2	16	48		E-59	E-52	E-47	E-43	E-33										
1	16	48	E-66	E-57	E-45	E-35	E-30											
1 3/8	14	54			E-54	E-43	E-36	E-28										
1 3/8	14	60				E-60	E-54	E-43	E-37	E-37	E-30	E-27						
1 1/2	14	60				E-57	E-48		E-38	E-33	E-27							
2 1/2	15	66						E-57	E-54	E-46	E-41	E-34	E-31	E-26				
2	14	66						E-56	E-48	E-40	E-35	E-30	E-26					
	14	72						E-62	E-54	E-44	E-39	E-32	E-29	E-25				
2 1/2	15 1/2	72								E-55	E-51	E-43	E-38	E-33	E-29			
2 3/8	14	78							E-64	E-52	E-46	E-39	E-35	E-30				
2 1/2	16	84									E-64	E-54	E-49	E-41	E-38	E-30		
2 11/16	20	96													E-59	E-51		

Table C-3. Bridge Capacities Expressed in Cooper's E Rating as Reflected in the Dimensions of Rectangular Wooden Stringers

Width (in.)	Depth (in.)	Span length (ft)						
		10	12	14	16	18	20	22
18	12	E-16	E-12					
18	14	E-22	E-18	E-10				
18	16	E-28	E-20	E-15	E-10			
18	18	E-38	E-26	E-18	E-14	E-12		
20	12	E-18	E-12					
20	14	E-25	E-17	E-12				
20	16	E-33	E-23	E-16	E-12	E-10		
20	18	E-43	E-29	E-21	E-16	E-13	E-10	
24	12	E-22	E-15	E-11				
24	14	E-30	E-21	E-14	E-11			
24	16	E-40	E-28	E-20	E-15	E-12		
24	18	E-52	E-36	E-25	E-19	E-15	E-12	E-10
36	12	E-34	E-23	E-17	E-12	E-10		
36	14	E-47	E-32	E-23	E-17	E-14	E-11	
36	16	E-62	E-43	E-30	E-23	E-19	E-15	
36	18	E-78	E-53	E-39	E-30	E-24	E-20	E-16
40	12	E-38	E-26	E-19	E-14	E-11		
40	14	E-52	E-36	E-26	E-20	E-16	E-12	
40	16	E-69	E-47	E-35	E-26	E-21	E-17	
40	18	E-87	E-60	E-44	E-34	E-27	E-22	E-18
48	12	E-46	E-31	E-23	E-17	E-13		
48	14	E-63	E-43	E-31	E-24	E-19	E-15	
48	16	E-83	E-57	E-41	E-32	E-26	E-21	
48	18	E-105	E-73	E-53	E-41	E-33	E-27	E-22
54	12	E-52	E-35	E-27	E-19	E-15		
54	14	E-72	E-49	E-35	E-22	E-18		
54	16	E-94	E-65	E-46	E-36	E-29	E-24	
54	18	E-119	E-82	E-60	E-46	E-38	E-30	E-25
60	12	E-58	E-40	E-30	E-22	E-17		
60	14	E-79	E-55	E-39	E-30	E-25	E-20	
60	16	E-104	E-72	E-52	E-40	E-33	E-27	
60	18	E-132	E-92	E-67	E-52	E-42	E-32	E-28

Note. In computing loading for bridges of wooden stringer construction, use the total width of all stringers under one track and the depth of one stringer.

Table C-4. Average Values of Rolling Resistance

Pounds per ton of train	Condition of track
5	Exceptionally good
6	Good to fair
7	Fair to poor
8	Poor
9 and 10	Very poor

Table C-5. Effect of Weather on Hauling Power of Locomotives

Most adverse temperature in °F	Loss in hauling (percent)	Weather factor (percent)
Above +32	0	100
+16 to +32	5	95
0 to +15	10	90
-1 to -10	15	85
-11 to -20	20	80
-21 to -25	25	75
-26 to -30	30	70
-31 to -35	35	65
-36 to -40	40	60
-41 to -45	45	55
-46 to -50	50	50

Table C-6. Determining Average Speed Values

Condition of track	Percent of grade	Average speed (mph)			
		Single track		Double track	
		(mph)	(kmph)	(mph)	(kmph)
Exceptionally good	1 percent or less	12	19.3	14	22.5
Good to fair	1.5 percent or less	10	16.1	12	19.3
Fair to poor	2.5 percent or less	8	12.9	10	16.1
Poor	3 percent or less	6	9.6	8	12.9

Notes.

1. The most restrictive factor governs the speed selected.
2. In using the table for average speed factor, consider the following:
 - a. If the condition of track and/or the percent of grade is not known, use an average speed value of 8 miles per hour for single track and 10 miles per hour for double track.
 - b. Where the most restrictive factor occurs for a comparatively short distance—that is, less than 10 percent of the division—use the next higher average speed.
 - c. Where average speed falls below 6 miles per hour because of the gradelings, reduce the tonnage to increase speed (2-percent reduction in gross tonnage will increase speed 1 mile per hour).

Table C-7. Characteristics of Rolling Stock

Type of car	Gage	Capacity (tons)	Tare weight (tons)	Inside dimensions		
				Length	Width	Height
A. US Rolling Stock						
Foreign service:						
Box, 30-ton	Narrow	30	13.6	34'5½"	7¾"	6'4"
Box, 40-ton	Std to broad	40	18.5	40'6"	8'6"	6'5½"
Flat, 30-ton	Narrow	30	10.9	34'5¾"	7'2"	
Flat, 40-ton	Std to broad	40	14.5	40'9"	8'7¼"	
Flat, 80-ton	Std to broad	80	35.3	46'4"	9'8"	
Flat, depressed center, 70-ton	Std to broad	70	41.5	50'7"	9'8"	
Gondola, high-side, 30-ton	Narrow	30	13	34'5"	6'10½"	4'0"
Gondola, high-side, 40-ton	Std to broad	40	18	40'0"	8'3¾"	4'0"
Gondola, low-side, 30-ton	Narrow	30	12.1	34'6"	6'10½"	1'6"
Gondola, low-side, 40-ton	Std to broad	40	16	40'4½"	8'3¼"	1'6"
Tank, POL, 6,000-gal	Narrow	20	16	38'4¾"	*5'2½"	
Tank, POL, 10,000-gal	Std to broad	35	19	38'5¾"	*6'8"	
Domestic service:						
Box, 50-ton	Std	50	23	40'6"	9'2"	11'0"
Flat, 50-ton	Std	50	25.5	43'3"	10'6"	3'8"
Flat, 70-ton	Std	70	27	49'11"	10'3"	3'8½"
Flat, 100-ton	Std	100	35	54'0"	10'6½"	4'5¾"
Gondola, high-side, 50-ton	Std	50	25	41'6"	9'6"	4'6"
Gondola, low-side, 50-ton	Std	50	23	41'6"	9'6"	3'0"
Tank, POL, 10,000-gal	Std	50	23	42'1½"	*6'6¾"	
B. European Rolling Stock						
Flat, 66-ton (SSys 55)	Std	67	22.5	35'3¾"	31'2"	
Flat, 55-ton (SSys 45)	Std	57	17.8	35'3¾"	31'2"	
Flat, 90-ton (FF1m)	Std	95	32.5	50'11¾"	46'8"	
Flat, 88-ton (SSym 46)	Std	90	24.5	43'4"	39'½"	
Flat, 46-ton (FF1)	Std	47.4	31.8	66'11¾"	62'3¼"	
Flat, 50-ton (FF)	Std	50	18.2	44'9¾"	40'9"	
Tank, 16,000-gal	Std	69.3	23.9	40'8¼"		
Tank, 9,900-gal	Std	40	17.4	40'9¾"		
Tank, 10,000-gal	Std	40	18.6	42'1½"		

*Inside dimensions

Note. Average payload for each type of car, except tank cars, is 50 percent of rated capacity in tons.

Table C-8. Disposition of Rolling Stock

Disposition	Rolling stock required
At base of operation	2 day's dispatch
Forward traffic	1 day's dispatch per division
Return traffic	1 day's dispatch per division
At the railhead	1 day's dispatch

Table C-9. Terminal Time Average Values

Type of motive power	Hours
Diesel-electric	3
Steam	8

Table C-10. Disposition of Switch Engines

Location	Switch engines required
Port or loading terminal	1 per 67 cars dispatched and received per day
Division terminals	1 per 100 cars passing per day
Railhead or unloading terminals	1 per 67 cars dispatched and received per day

Table C-11. Fuel Requirements for Diesel-Electric Locomotives

Type of locomotive	Type of operation	Estimated average rate of fuel oil consumption	
		Gal per train mile	Gal per hour
Standard gage:			
0-6-6-0, 120-ton -----	Road switcher	2.5	11.5
0-4-4-0, 50-ton -----	Road switcher	.9	8.0
Narrow gage:			
0-6-6-0, 80-ton -----	Road switcher	1.5	10.0
0-4-4-0, 48-ton -----	Road switcher	.9	8.0

APPENDIX D

STABILITY OPERATIONS

D-1. General

Stability operations are those types of internal defense and internal development operations and assistance provided by the Armed Forces to maintain, restore, or establish a climate of order within which responsible government can function effectively and without which progress cannot be achieved. For further information see FM 31-23.

D-2. Technical Assistance and Training

The Army transportation railway service (TRS) can support stability operations by providing technical assistance and advice relative to the construction, repair, maintenance, and operation of railways in the host country. Personnel of the TRS may provide this assistance by various means as the situation dictates. As individuals or small training teams they may work directly with appropriate agencies of the host country to provide technical assistance and advice relative to the operation of the railway transportation system, improvement in the railway training program, modernization and rehabilitation of equipment, improvement of maintenance facilities, and the establishment of movement priority and movement control programs. Another method of providing such assistance to the host country can be in coordination with some other agency of the US Government, such as the US Agency for International Development (AID).

D-3. Military Civic Action

a. The use of military personnel and resources to support or implement a national internal development program is military civic action.

b. Personnel and equipment of the Army TRS may have a great potential for supporting civic action. Although individuals and units are adapt-

able for certain types of activities because of the nature of their missions and the types of equipment and skills they employ, there are many other areas in which units may contribute because of the varied educational background and vocational experience of unit personnel. Civilian skills in such areas as the building trades, teaching, engineering, forestry, sanitation, mining, animal husbandry, farming, and road construction, if properly applied, can do much to assist the economy, health, and overall well-being of the civilian community. A partial list of areas in which these skills might be applied follows:

(1) Assisting in construction projects by providing advice, supplies, and equipment.

(2) Providing advice, assistance, and equipment for debris removal, land clearance, and drainage projects.

(3) Providing advice and assistance relative to harvesting crops.

(4) Repairing and rehabilitating machinery and transport equipment.

(5) Training indigenous personnel in skills and trades useful to the local economy.

(6) Providing teachers for schools and adult vocational and technical training.

(7) Sponsoring community projects such as orphanages, schools, dispensaries, and civic centers.

(8) Providing labor, material, equipment, and transport assistance for disaster relief.

(9) Providing instruction, advice, and assistance in professional areas such as engineering, if such skills are available in the unit.

(10) Motivating the populace to help themselves by showing them how to get the utmost benefit with the use of locally available materials and tools.

APPENDIX E
CONVERSION FACTORS

A. Linear measure.

Meter ¹	Inches	Feet	Yards	Rods	Chains	Miles		Kilometers	Cables' lengths	Fathoms
						Statute	Nautical ²			
1.0	39.37	3.28083	1.09361	0.19884	0.04971	0.0006214	0.0005395	0.001	0.00454	0.546
.0254	1.0	.0833	.0278	.00505	.00126	.00001578	.00001371	.0000254	.000116	.0139
.3048	12.0	1.0	.3333	.0606	.0151	.0001894	.0001645	.0003048	.00139	.167
.9144	36.0	3.0	1.0	.1818	.04545	.0005682	.0004934	.0009144	.00417	.500
5.0292	198.0	16.5	5.5	1.0	.25	.003125	.002714	.005029	.0228	2.76
20.1168	792.0	66.0	22.0	4.0	1.0	.0125	.01085	.02012	.091	11.0
1,609.35	63,360.0	5,280.0	1,760.0	320.0	80.0	1.0	.8684	1.6095	7.32	879.0
1,853.25	72,962.5	6,080.2	2,026.73	368.497	92.1243	1.15155	1.0	1.85325	8.46	1,010.0
1,000.0	39,370.0	3,280.83	1,093.61	198.838	49.7096	.6214	.5396	1.0	4.56	546.0
219.5	8,640.0	720.0	240.0	43.6	10.9	.1364	.1184	.2195	1.0	120.0
1.829	72.0	6.0	2.0	.363	.091	.0014	.00098	.00183	.00835	1.0

¹ 1 meter = 10 decimeters = 100 centimeters = 1,000 millimeters.

² A nautical mile is the length on the earth's surface of an arc subtended by 1 minute of angle at the center of the earth. Therefore, the circumference of the earth is equivalent in nautical miles to the number of minutes in a circle ($360 \times 60 = 21,600$).

B. Surface measure.

Square meters	Square inches	Square feet	Square yards	Square rods	Acres	Hectares	Square miles (statute)	Square ki
1.0	1,550.0	10.764	1.196	.03954	0.000247	0.0001	0.000000386	0.00000
.00065	1.0	.0069	.00077	.00000026	.00000016	.000000065	.00000000025	.00000
.0929	144.0	1.0	.1111	.00367	.00002296	.00000929	.0000000359	.00000
.8361	1,296.0	9.0	1.0	.0331	.0002066	.0000836	.000000323	.00000
25.293	39,204.0	272.25	30.25	1.0	.00625	.000253	.00000977	.00002
4,046.8	6,262,640.0	43,560.0	4,840.0	160.0	1.0	.4047	.00156	.00405
10,000.0	15,499,969.0	107,639.0	11,960.0	395.37	2.471	1.0	.00356	.01
2,589,999.0	Sq ft $\times$ 144	27,878,400.0	3,097,600.0	102,400.0	640.0	259.0	1.0	2.59
1,000,000.0	Sq ft $\times$ 144	10,763,867.0	1,195,985.0	39,537.0	247.0	247.0	.3861	1.0

C. Weight.

Kilograms (kg)	Grains (gr)	Ounces		Pounds		Tons		
		Troy	Avoirdupois (avdp)	Troy	Avoirdupois (avdp)	Short (2,000 lb)	Long (2,204 lb)	Metric (1,000 kg) (2,204.6 lb)
1.0	15,432.4	35.1507	35.274	2.67923	2.20462	0.001102	0.0009842	0.001
.0000648	1.0	.002083	.0002286	.0001736	.0001429	.00000006	.00000006	.00000006
.0311	480.0	1.0	1.09714	.08333	.06857	.00003429	.00003429	.0000311
.02385	437.5	.01146	1.0	.07595	.0625	.00003125	.0000279	.00002835
.37324	5,760.0	12.0	13.1657	1.0	.82286	.0004114	.0003674	.0003732
.45359	7,000.0	14.5833	16.0	1.21528	1.0	.0005	.0004464	.004536
907.185	14,000,000.0	29,166.7	32,000.0	2,430.56	2,000.0	1.0	.89286	.90719
1,016.05	15,680,000.0	32,666.7	35,840.0	2,722.22	2,240.0	1.12	1.0	1.01605
1,000.0	15,432,356.0	32,150.7	35,274.0	2,679.23	2,204.62	1.10232	.98421	1.0

APPENDIX F

STANAG 2079

REAR AREA SECURITY AND REAR AREA DAMAGE CONTROL

STANAG 2079
(Edition No. 3)

RESERVATIONS

- GREECE: The validity of this STANAG is applicable to the 'Combat Zone' only, since in the ambit of the Communications Zone, the security planning for the Rear Areas and Mass Destruction Control falls within the exclusive national competence.
- ITALY: The validity of this STANAG is applicable to the 'Combat Zone' only, since in the ambit of the Communications Zone, the security planning for the Rear Areas and Mass Destruction Control falls within the exclusive national competence.
- NETHERLANDS: The implementation of paragraphs 5.b. and 7.d. by units of the Royal NL Air Force will be considered on a case by case basis.
- UNITED STATES: The United States Navy (USMC) will use the term "Administrative and Logistics" as the heading for paragraph 4 in the Rear Area Security Operation Order and the Rear Area Damage Control Operation Order in lieu of the present heading of "Service Support."

Agreed English/French texts

STANAG 2079
(Edition No. 3)

DETAILS OF AGREEMENT (DofA)REAR AREA SECURITY AND REAR AREA DAMAGE CONTROL

- Annexes: A(DofA). Rear Area Security Operation Order.
B(DofA). Rear Area Damage Control Operation Order.

AGREEMENT

1. It is agreed that the NATO Armed Forces are to establish a system providing for rear area security and rear area damage control based on the principles and instructions contained herein and Annexes A and B(DofA).

GENERAL

2. This Agreement is intended to provide for such planning as must be done by Field Armies, Communications Zone and/or Sections and com-

parable commands, and units and installations within these commands. While rear damage control covered herein deals only with damage to military installations, it must be realized that damage to any civilian installation will have a repercussion on the military situation. It is emphasized that this Agreement does not grant any additional powers to the NATO Forces with respect to civilian authorities and civilian responsibilities. Co-operation with national military and civilian officials is essential at all levels and is to be accomplished through the national military authorities.

DEFINITIONS

3. The following terms and definitions are used for the purpose of this Agreement.

- a. Rear Area. Rear Area includes:
 - (1) The Land Communications Zone.
 - (2) The rear of the Land Combat Zone in which are located the bulk of the logistical installations. (Army Service Area).
- b. Rear Area Security. Rear Area Security includes the measures taken prior to, during and/or after an enemy airborne attack, sabotage action, infiltration, guerrilla action and/or initiation of psychological or propaganda warfare to minimize the effects thereof.¹
- c. Rear Area Damage Control. Rear Area Damage Control includes the measures taken in military operations prior to, during and after a mass destruction attack or natural disaster, to minimize the immediate effects thereof.

GENERAL PRINCIPLES

4. The following general principles concerning the preparation, use and format of plans and orders are applicable to both rear area security and to rear area damage control:

- a. For the Field Army, Communications Zone, Sections of the Communications Zone and comparable commands, it is desirable that responsibility for rear area security and for rear area damage control be combined.
- b. An effective system for rear area security, rear area damage control and administrative support must possess the following characteristics:
 - (1) A definite fixing of geographic responsibilities for these activities.
 - (2) A single commander responsible for all three functions in the same geographic area.
 - (3) An operations centre (and alternate operations centre) and the necessary communications.
 - (4) Provision for prompt integration of transit or lodger units into plans.
- c. The commander's plan for rear area security and for rear area damage control should be included in appropriate paragraphs of an Operations Order and/or appropriate annexes (see STANAG 2014).

Note.

¹ Definition is taken from AAP-6—The NATO Glossary of Military Terms and Definitions in English and French.

- d. Close co-ordination of plans for rear area security and rear area damage control is necessary at all levels.
- e. Full use should be made of automatic data processing equipment and other electronic and communications equipment to receive, collate and disseminate intelligence, radiological data including fallout and other data, and to assist in the control of rear area security and rear area damage control operations.

REAR AREA SECURITY

- 5. In addition to the general principles outlined in paragraph 4, the following principles are applicable in the planning for rear area security:
 - a. The object of rear area security planning is to:
 - (1) Protect installations and activities located in the rear area against enemy actions, as defined in paragraph 3.b.
 - (2) Prevent or minimize enemy ground forces (both regular and irregular) interference with logistical and administrative operations.
 - (3) Destroy or neutralize the hostile forces involved.
 - b. Rear area security depends upon:
 - (1) Troops assigned the primary mission of rear security (e.g. national territorial troops, combat troops).
 - (2) Other combat troops located temporarily within the area.
 - (3) Service troops assigned within the area.
 - c. All units are responsible for their local security but, normally, service troops are not allotted any security task other than that of their own installation.
 - d. Tasks of other than service troops may include, but are not necessarily limited to:
 - (1) Relief and rescue of attacked installations and units.
 - (2) Route patrolling and convoy protection.
 - (3) Surveillance of possible redoubt areas of guerrillas or infiltrators.
 - (4) Planning for defence of possible drop and landing zones.
 - (5) Finding, fixing and destroying enemy forces operating in rear areas.
- 6. Annex A(DofA) outlines, in the Operation Order format, those items of basic information (other than that which would normally go into the order) that should be included in a typical rear area security operations plan or order. This is not to be construed as a complete order, nor is the information shown to be considered all of the possible additional information that might be required.

REAR AREA DAMAGE CONTROL

- 7. In addition to the general principles outlined in paragraph 4, the following principles are applicable in the planning for rear area damage control:
 - a. The Army Service Area and Communications Zone contains lucrative targets for attack by mass destruction weapons. Detailed plans

are therefore required to minimize the damage effects of such an attack.

- b. Rear area damage control plans are prepared, based upon an assumed degree of damage, to ensure provision of the means for minimizing personnel casualties and damage to installations resulting from enemy action or natural disaster. They are based upon the existing command organization; the scope of the plans depend on the size of the area, location and size of installations and communication routes and facilities. Subordinate commanders are to prepare detailed plans based upon the overall plan.

- c. Rear area damage control measures provide for, but are not necessarily limited to, the following:

- (1) Prior to an Attack:

- (a) Clear lines of authority and responsibility down to the lowest level.
- (b) Communications and a warning system or warning systems for the reporting of nuclear detonations, radio-active fallout and biological and chemical attacks.
- (c) Proper dispersion within and between installations, continuously planned and executed.
- (d) Preparation of necessary plans and SOP, to include reporting of information required for post-strike analysis.
- (e) Organization equipping and training of all personnel in rear area damage control operation.
- (f) Appropriate use of cover and concealment.
- (g) Allocation, organization and full utilization of available transportation and equipment, to include alternate plans.
- (h) Deception measures.

- (2) During and After an Attack:

- (a) Rapid assessment of the damage and its immediate effect on operations.
- (b) Control of personnel and traffic either in co-ordination with the local civilian authorities or by the military when essential for continued military operations and the civilian police are inoperative.
- (c) Fire prevention and fire fighting.
- (d) First aid and evacuation of casualties.
- (e) Warning and protection against chemical, biological and radiological hazards.
- (f) Emergency supply of food, clothing and water.
- (g) Explosive ordnance reconnaissance and disposal.
- (h) Initiation of salvage operations.
- (i) Decontamination of vital areas contaminated with radioactive material or chemical or biological agents.

- d. Available service units normally furnish personnel, equipment and specialized assistance to carry out rear area damage control measures. The number of labour and rescue squads each unit is to furnish is prescribed in the current rear area damage control plan.

- e. Fallout from a nuclear detonation and contamination by chemical or biological agents pose a serious threat to the safety of personnel and the utilization of material and may be a limiting factor in the planning for and conduct of these operations (e.g. exposure time may be critical).

8. Annex B(DofA) outlines, in the Operation Order format, those items of basic information (other than that which would normally go into the order) that should be included in a typical rear area damage control plan or order. This is not to be construed as a complete order, nor is the information shown to be considered all of the possible additional information that might be required.

IMPLEMENTATION OF THE AGREEMENT

9. This STANAG will be considered to have been implemented when the necessary orders/instructions putting the system detailed in this Agreement into effect have been issued to the Forces concerned.

ANNEX A(DofA) TO STANAG 2079 (Edition No. 3)

REAR AREA SECURITY OPERATION ORDER (See STANAG 2014)

(SECURITY CLASSIFICATION)
(Change from oral orders, if any)

Copy No. _____ of _____ copies.
Issuing Headquarters.
Place of Issue (may be in code).
Date-Time Group of Signature.
Message Reference Number.

REAR AREA SECURITY OPERATION ORDER NUMBER

References: Maps, charts and relevant documents (See STANAG 2029).

Time Zone Used Throughout the Order

Task Organization: See STANAG 2014.

1. SITUATION

Within the explanation given in STANAG 2014, the following points normally will be covered:

- a. Enemy Forces. Enemy capabilities to:
 - (1) Use nuclear, biological and chemical weapons.
 - (2) Assault with airborne elements and other regular units.
 - (3) Mount an attack with irregular forces.
 - (4) Execute air or guided missile attacks.
 - (5) Employ psychological warfare.
- b. Friendly Forces/Civilian Authorities
- c. Attachments and Detachments
- d. Commander's Evaluation

2. MISSION

See STANAG 2014.

3. EXECUTION

Within the explanation given in STANAG 2014, the following points normally are to be covered:

- a. General.
- b. Combat and Security Units.
- c. Technical and Administrative Units/Agencies.
- d. Co-operation with Civilian Authorities.
- e. Co-ordination within the Forces.

4. SERVICE SUPPORT

5. COMMAND AND SIGNAL

Acknowledgement	Signature of Commander
Instructions	(See PART I, paragraph 22, STANAG 2014)
Authentication:	
Annexes:	
Distribution:	

(SECURITY CLASSIFICATION)

ANNEX B(DofA) TO STANAG 2079 (Edition No. 3)
REAR AREA DAMAGE CONTROL OPERATION ORDER
(See STANAG 2014)

(SECURITY CLASSIFICATION)

(Change from oral orders, if any)

Copy No. _____ of _____ copies.
 Issuing Headquarters.
 Place of Issue (may be in code).
 Date-Time Group of Signature.
 Message Reference Number.

REAR AREA DAMAGE CONTROL OPERATION ORDER NUMBER

References: Maps, charts and relevant documents (See STANAG 2029).

Time Zone Used Throughout the Order

Task Organization. See STANAG 2014.

1. SITUATION

Within the explanation given in STANAG 2014, the following points normally are to be covered:

- a. Enemy Forces. Enemy capabilities to execute nuclear, biological and chemical attacks and conventional air strikes without warning.
- b. Friendly Forces. The assistance provided by the local, adjacent units and the civilian authorities.
- c. Attachments and Detachments.
- d. Commander's Evaluation.

2. MISSION

3. EXECUTION

Within the explanation given in STANAG 2014, the following points normally are to be covered:

- a. Concept of operation.
- b. Control responsibility in order of priority. (Responsibility, in order of priority, for the assumption of control of operations in the event one or more of the headquarters becomes inoperable).
- c. Troops, equipment and installations. (Responsibility for providing troops, equipment and facilities to support operations of other subdivisions and installations).
- d. Control points.
- e. Co-ordinating instructions. (Necessary co-ordination to be effected with adjacent commanders, territorial commanders and civilian authorities should be specified).

4. SERVICE SUPPORT

5. COMMAND AND SIGNAL

Acknowledgement

Instructions

Authentication:

Annexes:

Distribution:

Signature of Commander

(See PART I, paragraph 22, STANAG 2014)

(SECURITY CLASSIFICATION)



APPENDIX G
STANAG 2113
DESTRUCTION OF MILITARY TECHNICAL EQUIPMENT

STANAG 2113

Agreed English/French Texts.

DETAILS OF AGREEMENT (DofA)
DESTRUCTION OF MILITARY TECHNICAL EQUIPMENT

Annex: A(DofA) Priorities for Destruction of Parts of Military Technical Equipment.

AGREEMENT

1. The NATO Army Forces agree:
 - a. That it is essential to destroy to the maximum degree possible military technical equipment, abandoned in wartime operations, to prevent its eventual repair and use by the enemy.
 - b. To follow the principles and priorities set forth in this Agreement in the destruction of their own equipment, when required.

PRINCIPLES AND PRIORITIES

2. Detailed Methods. Detailed methods of destroying individual items of equipment are to be included in the applicable technical publications, user handbooks and drill manuals.
3. Means of Destruction. Nations are to provide for the means of destruction for their own equipment.
4. Degree of Damage.
 - a. General. Methods of destruction should achieve such damage to equipment and essential spare parts that it will not be possible to restore the equipment to a usable condition in the combat zone either by repair or cannibalization.
 - b. Classified Equipment. Classified equipment must be destroyed in such degree as to prevent duplication by, or revealing means of operation or function, whenever possible, to the enemy.
 - c. Associated Classified Documents. Any classified documents, notes, instructions, or other written material pertaining to function, operation, maintenance, or employment, including drawings or parts lists, must be destroyed in a manner to render them useless to the enemy.
5. Priorities for Destruction.
 - a. Priority must always be given to the destruction of classified equipment and associated documents.

- b. When lack of time and/or stores prevents complete destruction of equipment, priority is to be given to the destruction of essential parts, and the same parts are to be destroyed on all like equipment.
 - c. A guide to priorities for destruction of parts for various groups of equipment is contained in Annex A (DofA) to this STANAG.
6. **Equipment Installed in Vehicles.** Equipment installed in vehicles should be destroyed in accordance with the priorities for the equipment itself, taking into account the relative importance of the installed equipment and the vehicle itself.
7. **Spare Parts.** The same priority, for destruction of component parts of a major item necessary to render that item inoperable, must be given to the destruction of similar components in spare parts storage areas.
8. **Cryptographic Equipment and Material.** The detailed destruction procedure to be followed in order to ensure the rapid and effective destruction of all types of cryptographic equipment and material is to be specified in instructions issued by the appropriate communication security authority.
9. **Authorization.** The authority for ordering the destruction of equipment is to be vested in the divisional and higher commanders who may delegate authority to subordinate commanders when the situation requires.
10. **Reporting.** The reporting of the destruction of equipment is to be done through command channels.

IMPLEMENTATION OF THE AGREEMENT

11. This STANAG will be considered to have been implemented when the priorities indicated therein have been incorporated in national documents detailing the method required for destroying the equipment concerned.

ANNEX A (DofA) TO STANAG 2113

PRIORITIES FOR DESTRUCTION OF PARTS OF MILITARY TECHNICAL EQUIPMENT

EQUIPMENT	PRIORITY	PARTS
1. VEHICLES (INCLUDING TANKS AND ENGINEER EQUIPMENT	1	Carburetor/fuel pump/injector/distributor.
	2	Engine block and cooling system.
	3	Tires/tracks and suspensions.
	4	Mechanical or hydraulic systems (where applicable).
	5	Differentials.
	6	Frame.
2. GUNS	1	Breech, breech mechanism, and spares.
	2	Recoil mechanism.
	3	Tube.
	4	Sighting and fire control equipment (Priority 1 for Anti-Aircraft guns).
	5	Carriage and tires.

EQUIPMENT	PRIORITY	PARTS
3. SMALL ARMS	1	Breech mechanism.
	2	Barrel.
	3	Sighting equipment (including Infra-red).
	4	Mounts.
4. OPTICAL EQUIPMENT	1	Optical parts.
	2	Mechanical components.
5. RADIO	1	Transmitter (oscillators and frequency generators).
	2	Receiver.
	3	Remote control units or switchboards (exchanges) and operating terminals.
	4	Power supply and/or generator set.
	5	Antennae.
	6	Tuning heads.
6. RADAR AND OTHER ELECTRONIC EQUIPMENT	1	Frequency determining components, records, operating instructions, which are subject to security regulations, and identification material (Identification Friend or Foe (IFF)).
	2	Antennae and associated components such as radiators, reflectors and optics.
	3	Transmission lines and waveguides.
	4	Transmitter high voltage components.
	5	Control consoles, displays, plotting boards.
	6	Cable systems.
	7	Automatic devices.
	8	Other control panels and generators.
	9	Carriage and tires.
7. GUIDED MISSILE SYSTEMS	1	Battery control centers.
	2	Missile guidance equipment (including homing systems).
	3	Launchers including control circuits.
	4	Missiles.
	5	Measuring and test equipment.
	6	Generators and cable systems.
8. AIRCRAFT AND SURVEILLANCE DRONES	1	Identification (IFF) equipment, other classified equipment, publications and documents pertaining thereto, and

EQUIPMENT

PRIORITY

PARTS

other materiel as defined by the national government concerned.

2 Installed armament. (Use sub-priorities for Group 2, Guns, or Group 3, Small Arms, as appropriate.)

3 Engine Assembly. (Priorities for destruction of magnetos, carburetors, compressors, turbines and other engine sub-assemblies to be determined by national governments, depending on type of aircraft involved and time available for destruction.)

4 Airframe/control surfaces/undercarriage. (Priorities for destruction of propellers, hub-rotor blades, gear boxes, drive shaft, transmissions, and other sub-assemblies (not already destroyed in priority 3) to be determined by national governments, depending on type of aircraft involved and time available for destruction.)

5 Instruments, radios, and electronic equipment (not included in priority 1).

6 Electrical, fuel, and hydraulic systems.

9. ROCKETS

1 Launcher.

2 Rocket.

3 Sights and fire control equipment.

APPENDIX H

STANAG 2153

**PARALLEL MARKING OF SPECIAL FLAT WAGONS AND HEAVY
MILITARY VEHICLES AND MILITARY VEHICLES USING OR
ABLE TO USE THE P.P.I. GAUGE**

RESERVATION

- UNITED STATES: a. The United States will reserve on the provisions of paragraph 12 (DofA), and Annexes D and E of STANAG 2153 (size of vehicle mark on heavy military vehicles).
- b. The United States will mark each vehicle tendered for rail movement in accordance with the classification mark required by Annexes D and E, STANAG 2153, but said marking will have the following characteristics:
- (1) Size of mark will be determined by the United States.
 - (2) Mark will be affixed externally to the vehicle and clearly visible by ground observation.
 - (3) Mark will not violate camouflage principles.
 - (4) Marks will be capable of being stored with on vehicle material (OVM) or permanently affixed as determined by the United States.
 - (5) Vehicles will bear a vehicle classification mark on the front and on the right side or as agreed to by the Panel of Experts.

ENCLOSURE II TO NAS(ARMY) (70)723

Agreed English/French Texts.

Preliminary Draft Edition No. 2 of
STANAG 2153DETAILS OF AGREEMENT (DofA)

PARALLEL MARKING OF SPECIAL FLAT WAGONS AND HEAVY
MILITARY VEHICLES AND MILITARY VEHICLES USING OR
ABLE TO USE THE P.P.I. GAUGE

- Annexes:
- | | |
|----------|--|
| A(DofA). | Rail Classification of Special Flat Wagons. |
| B(DofA). | Marking of Special Flat Wagons. |
| C(DofA). | Classification of Heavy Military Vehicles. |
| D(DofA). | Marking of Heavy Military Vehicles of Categories 4, 5, 6, 7 and 8. |
| E(DofA). | Marking of Heavy Military Vehicles of Categories 5.2 and 7.2. |
| F(DofA). | Marking of Military Vehicles Using the P.P.I. Gauge. |

AGREEMENT

1. The NATO Armed Forces agree to classify their special flat wagons in accordance with the terms of Annex A(DofA) and to mark them in accordance with Annex B(DofA), it being understood that such classification and marking will be carried out in coordination with the Railway Administrations who have registered the wagons. These Armed Forces agree to classify their heavy vehicles in accordance with the terms of Annex C(DofA) and to mark them in accordance with Annex D and E(DofA). They will keep each other mutually informed of the entry into service or the withdrawal of all types of heavy military vehicle. They also agree to classify military vehicles using the P.P.I. gauge in accordance with the terms of Annex F(DofA).

NEED FOR PARALLEL CLASSIFICATION OF SPECIAL FLAT WAGONS AND HEAVY MILITARY VEHICLES

2. The transport by rail of heavy military vehicles gives rise to numerous difficulties due to their characteristics which require, in general, the use of special type wagons which are in limited number. In addition, in almost all cases, these loads are outside the loading gauge of the railways (see STANAG 2805-E, Annex B(DofA)). In order to simplify the preliminary studies required for each of these exceptional movements, to facilitate the selection of wagons required and the control of loading by their inspectors, to accelerate clearance at unloading points, certain Railway Administrations have classified their special flat wagons into five categories, this classification also applies to wagons belonging to the Armed Forces stationed in Allied Command Europe. A special sign allows the wagons in each of these categories to be easily distinguished. Therefore, to obtain the maximum benefit from this classification it is important that the military heavy vehicles be also classified in categories and marked with the appropriate signs.

MARKING REQUIREMENTS FOR MILITARY VEHICLES USING OR ABLE TO USE THE PPI GAUGE

3. Some vehicles and equipment use the PPI gauge if loaded without special precautions, but which, if they have been submitted to special treatment such as simple dismantling, still remain within the P.P.I. gauge. Moreover, some vehicles and equipment use the P.P.I. gauge due to their actual contours or projecting parts which cannot be modified when loaded but require also to be submitted to special conditioning operations in view of their transport on wagons. If not dismantled as mentioned above the military equipment would inevitable be damaged during transportation, and could consequently be put out of use and sometimes cause accidents of a very serious nature. Thus it seems useful for safety reasons to draw the attention of military consignors and of personnel belonging to the Railway Administrations, to the obligation of carrying out the required dismantling by affixing on the equipment concerned a distinctive mark allowing their ready and unmistakable identification when loaded and to refer to the documents listing action to be taken.

DEFINITIONS

4. Special Flat Wagons. The term "Special flat wagons" (in the military sense) is applied to such flat wagons with characteristics corresponding to those of one of the categories listed in Annex A(DofA) as are suitable for the conveyance of heavy military vehicles.

5. Heavy Military Vehicles. The heavy military vehicles referred to in the present document include battle tanks, breakdown vehicles, self-propelled

guns and howitzers, armoured personnel carriers, heavy artillery tractors, bridge launchers, etc. These vehicles include only tracked vehicles weighing 20 tons or over, or items which, when loaded on a flat wagon with a floor height of 1.31 m. encroach on the PPI gauge (see STANAG 2805-E—Annex B(DofA)).

CLASSIFICATION AND MARKING OF SPECIAL FLAT WAGONS

6. Basis of Classification. The division of special flat wagons into five categories was done following a comparative study of the characteristics of the wagons and of the military vehicles as follows:

- a. Usable Length. In no case does the total length of the heavy military vehicles exceed the usable length of the wagons able to carry them, taking into account the overhand allowed by the "RIV" (International regulations concerning the reciprocal use of wagons in international traffic), Annex II, paragraph 6.
- b. Carrying Capacity. In no case is the maximum load the determining factor for the choice of wagons. The overriding factor is the restriction imposed by the short bearing surface of the tracks (3.00 to 5.00m).
- c. Strength Over a Given Bearing Length. The weight of heavy military vehicles varies from 20 to 66 tons, whereas the bearing length of their tracks is usually between 3.00 and 5.00 m. The strength was calculated for each category of wagons on the basis of the minimum bearing length of the military vehicle in the corresponding category.
- d. Usable Width. Determination of the usable width of the wagons is essential because, in most cases, the tracked vehicles are wider than the wagons suitable for their conveyance. The lateral overhang on either side must be restricted to a value equal to half the width of the vehicle track, less a safety margin of 0.05 m. The maximum width between the outside edges of the vehicle tracks must comply with the following formula.

$$1m = lu + d - 0.10 \text{ m.}$$

in which

1m = maximum width (width between outside edges of tracks)

lu = usable width of the wagon

d = width of vehicle track

0.10 m = essential safety margin (0.05 m × 2).

This formula is in conformity with the one used in STANAG 2805-E, Annex B, standard B.21. The usable width of the wagons is between 2.174 m and 3.15 m, whereas the bearing width of military vehicles varies from 2.00 to 4.01 m with a track-width of from 0.40 to 0.79 m, depending on the weight.

7. Classification. The classification table for special flat wagons is given at Annex A(DofA).

8. Miscellaneous Remarks on Classification.

- a. Loading of Two Heavy Military Vehicles on to the Same Wagon. The considerations mentioned in paragraph 5 above indicate that the determining factors in the choice of wagons are load authorized in relation to the bearing length and the usable width, whereas the usable length and the maximum load are always adequate when only one vehicle has to be loaded onto a wagon. Some wagons, with usable length of 13.00 m or more, can carry two heavy military vehicles; in this case, the four characteristics specified in paragraphs 5.a., b., c. and d. above become determining factors in the choice of the wagon.

- b. Progression. Progression in the characteristics of the different categories of wagons has been sought with a view to enabling a wagon to be placed, at any time, by another in a different category. However, this progression is not feasible in the case of the simultaneous loading of two heavy military vehicles onto the same wagon, since only a category 7 wagon can replace a category 5 wagon. Finally, although it is possible it is not desirable to replace ordinary flat wagons (Categories 0 to 3) by special flat wagons (Categories 4 to 8).

9. Military Marking of Special Flat Wagons. Special flat wagons bear markings, the shapes, dimensions, positions and colours of which are defined in Annex B(DofA).

RAIL CLASSIFICATION AND MARKING OF HEAVY MILITARY VEHICLES

10. Basis of Classification. See paragraph 6 above.

11. Classification. The classification table of heavy military vehicles is at Annex C(Dof A).

12. Loading of Two Heavy Military Vehicles on the Same Wagon. Categories 5.2 and 7.2 were created in order to reduce the number of wagons required for the transport. When loaded singly on a wagon, vehicles of categories 5.2 and 7.2. must be considered in the same way as those of the category (4, 5, 6 or 7) to which they normally belong.

13. Marking of Heavy Military Vehicles. Heavy military vehicles for movement by rail are to bear markings, the shapes, dimensions and colours of which are indicated in Annexes D and E(DofA). Vehicles which can load two at a time on one wagon are to bear the two different marks in accordance with Annex D (DofA) and Annex E (DofA).

MARKING OF MILITARY VEHICLES WHICH ARE ABLE TO USE OR USE THE PPI GAUGE

14. Some lightweight medium weight or heavy military vehicles use the PPI gauge when loaded onto ordinary flat or special wagons. According to their loading conditions they are to be classified into two categories:

- a. Vehicles using the international gauge if loaded without special precautions, but which, if they have been submitted to special treatment such as simple dismantling still remain within the PPI gauge. These vehicles are to be included in a list indicating those parts which will be dismantled so that they may meet the international gauge.
- b. Vehicles and equipment which use the gauge due to their actual contours or their projecting parts which cannot be modified when loaded onto a railway wagon. This equipment comes under the "out-of-gauge equipment." It is described in a sketchbook in which details of the special dismantling and conditioning operations are given for the equipment concerned.

15. Marking. The following marks will be affixed near the parallel marking or on a clearly visible place (on vehicles belonging to categories 4 to 8):

- a. One small red circular mark on all equipment constituting an ordinary load without using the international load when certain parts have been dismantled.
- b. Two small red circular marks on all equipment constituting an exceptional load.

Shape and dimensions of these markings are given at Annex F(DofA).

IMPLEMENTATION OF THE AGREEMENT

16. This STANAG will be considered to have been implemented when the necessary orders/instructions to adopt the method of marking described in this Agreement have been issued to the forces concerned.

H-5

H-5
H-5
H-5
H-5

ANNEX A TO THE DETAILS OF AGREEMENT
OF STANAG 2153

RAIL CLASSIFICATION OF SPECIAL FLAT WAGONS

Category	Carrying Capacity	Strength Over a Given Bearing Length	Usable Length	Minimum Usable Width
(a)	(b)	(c)	(d)	(e)
4	minimum: 34 t	$\frac{34 \text{ t}}{3.50 \text{ m}}$	minimum: 7.00 m	2.74 m
5	50 to 52 t	$\frac{44 \text{ t}}{3.50 \text{ m}}$	11.26 to 13.00 m	2.83
6	48 to 61 t	$\frac{48 \text{ t}}{3.50 \text{ m}}$	8.80 to 9.56	3.11 m
7	89 t	$\frac{62 \text{ t}}{4.00 \text{ m}}$	15.00 m	3.11 m
8	81 t	$\frac{76 \text{ t}}{4.00 \text{ m}}$	11.90 m	3.15 m

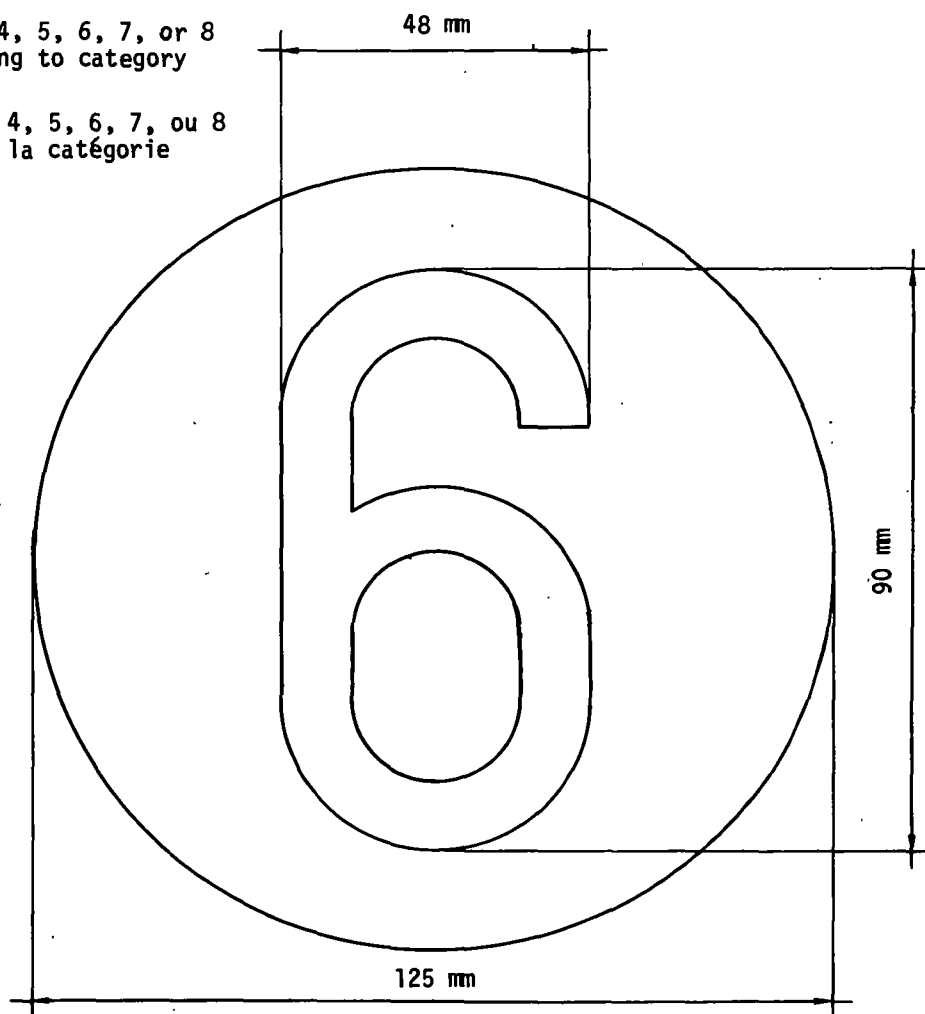
NATO - UNCLASSIFIEDMARKING OF SPECIAL FLAT WAGONS
MARQUAGE DES WAGONS PLATS SPECIAUXFigure 4, 5, 6, 7, or 8
according to categoryChiffre 4, 5, 6, 7, ou 8
suivant la catégoriePosition - on both sides of the body or of the side member, and on the right when facing the wagon.Colour - Dark figure on white.Emplacement - Sur les 2 faces latérales de la caisse ou du longeron de châssis, à droite en regardant le wagon.Couleur - Chiffre foncé sur fond blanc.OTAN - NON CLASSIFIE
B(DofA)-1/B(NdeA)-1

Figure H-1. MARKING OF SPECIAL FLAT WAGONS

CLASSIFICATION OF HEAVY MILITARY VEHICLES

A. LOADING OF ONE VEHICLE PER WAGON

Category	Minimum weight equipped for combat excluding personnel	Characteristics of vehicles			Category of special wagons appropriate for transport (2)
		Minimum bearing Length of tracks	Maximum length	Maximum width outside tracks (1)	
(a)	(b)	(c)	(d)	(e)	(f)
4	34 t	3.50 m	7.80 m	$1m = 2.74 m + d - 0.10 m$	4 to 8
5	44 t	3.50 m	9.60 m	$1m = 2.83 m + d - 0.10 m$	5 to 8
6	48 t	3.50 m	9.60 m	$1m = 3.11 m + d - 0.10 m$	6 to 8
7	62 t	4.00 m	12.70 m	$1m = 3.11 m + d - 0.10 m$	7 and 8
8	76 t	4.00 m	12.70 m	$1m = 3.15 m + d - 0.10 n$	8

Notes. (1) See explanation of formula $1m = 1u + d - 0.10 m$ at paragraph 5.d.

(2) The suitability of one or more categories of special flat wagons for the transport of a particular type of vehicle, as defined above, leaves the Railway Administrations free to make a preliminary study in each case of the possibilities of movement before authorizing the transport.

CLASSIFICATION OF HEAVY MILITARY VEHICLES

B. LOADING OF TWO VEHICLES PER WAGON

Characteristics of Vehicles					Category of special wagons appropriate for transport ⁽²⁾
Category	Maximum weight equipped for combat excluding personnel	Minimum bearing Length of tracks	Maximum Length	Maximum width outside tracks ⁽¹⁾	
(a)	(b)	(c)	(d)	(e)	(f)
2	2 × 25 t	2 × 3.00 m	2 × 6.30 m	$1m = 2.83 m + d - 0.10 m$	5 or 7
2	2 × 44 t	2 × 3.50 m	2 × 7.50 m	$1m = 3.11 m + d - 0.10 m$	7

Notes. ⁽¹⁾ See explanation of formula $1m = 1u + d - 0.100 m$ at para 6.d.

⁽²⁾ The suitability of one or more categories of special flat wagons for the transport of a particular type of vehicles, as defined above, leaves the Railway Administrations free to make a preliminary study in each case of the possibilities of movement before authorizing the transport.

NATO - UNCLASSIFIED

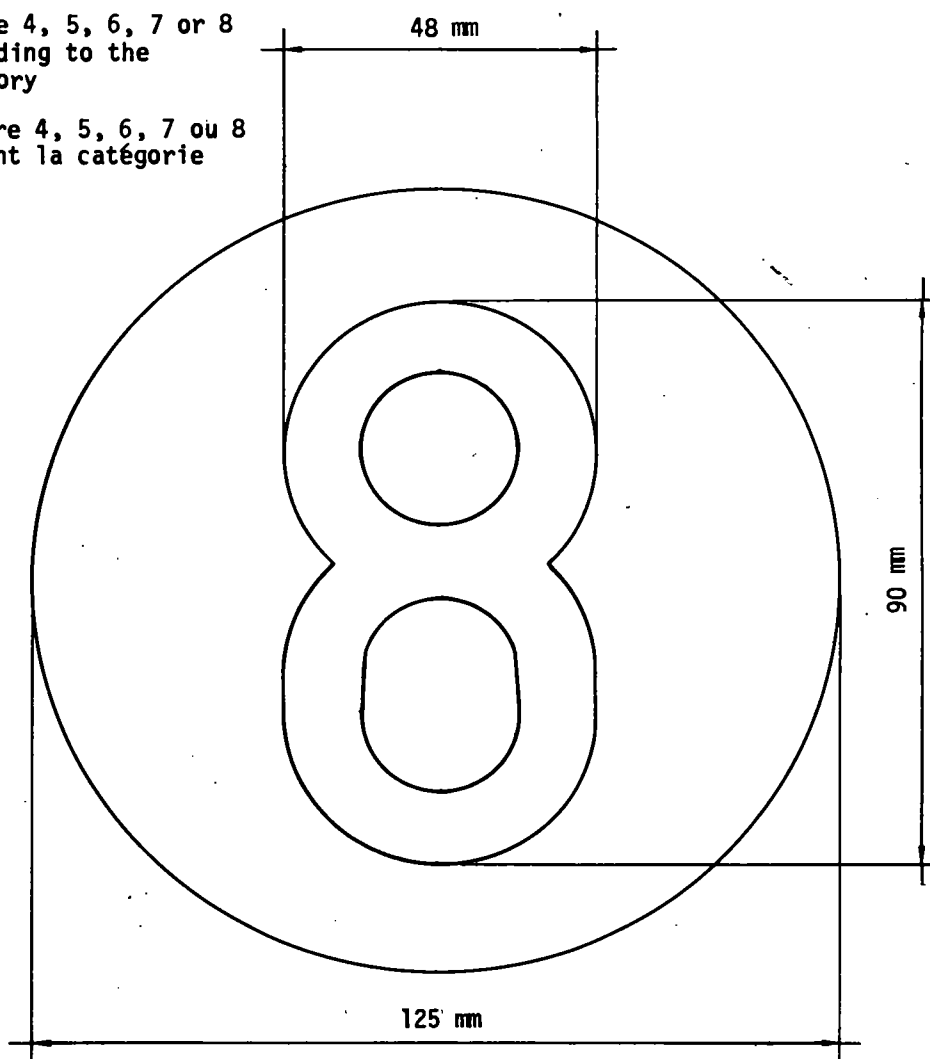
ANNEX/ANNEXE D
of/du STANAG 2153

MARKING OF HEAVY MILITARY VEHICLES OF CATEGORIES
4, 5, 6, 7 and 8

MARQUAGE DES VEHICULES MILITAIRES LOURDS DES CATEGORIES
4, 5, 6, 7 et 8

Figure 4, 5, 6, 7 or 8
according to the
category

Chiffre 4, 5, 6, 7 ou 8
suivant la catégorie



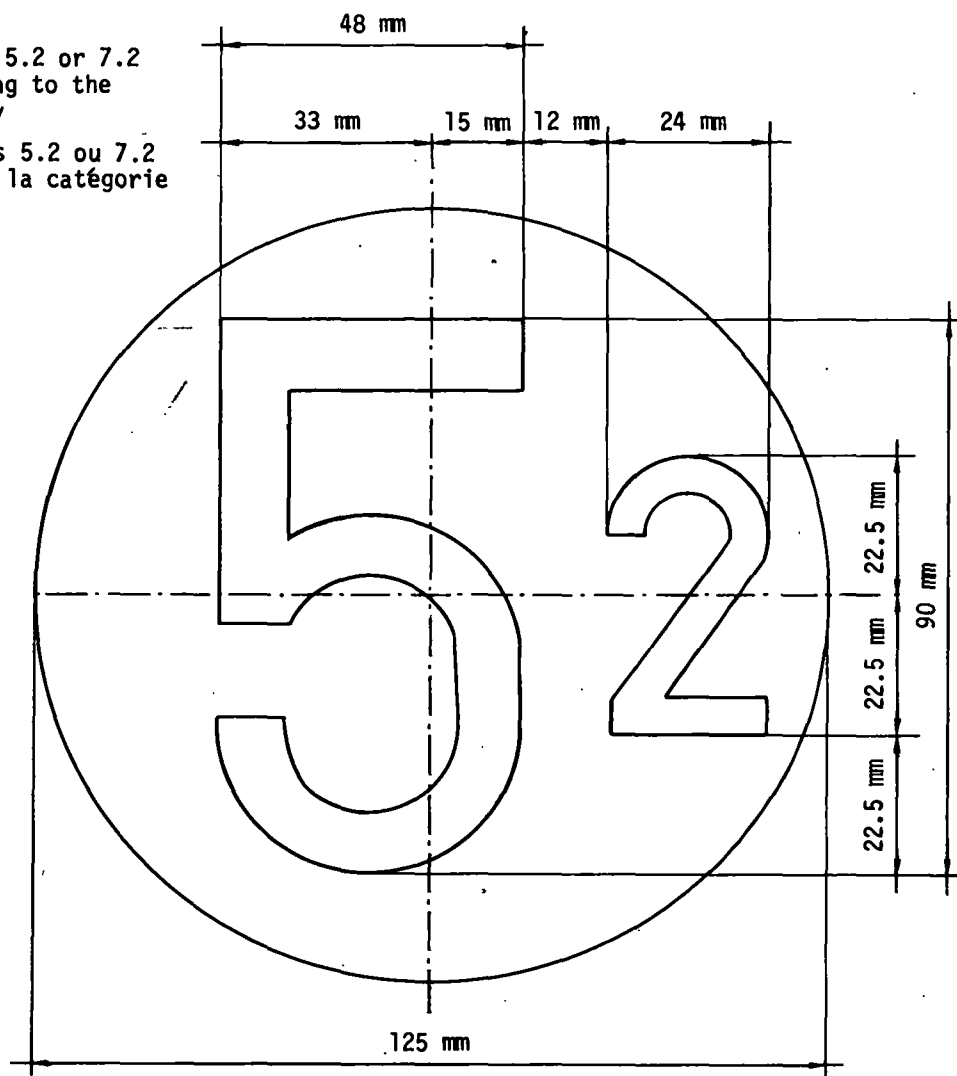
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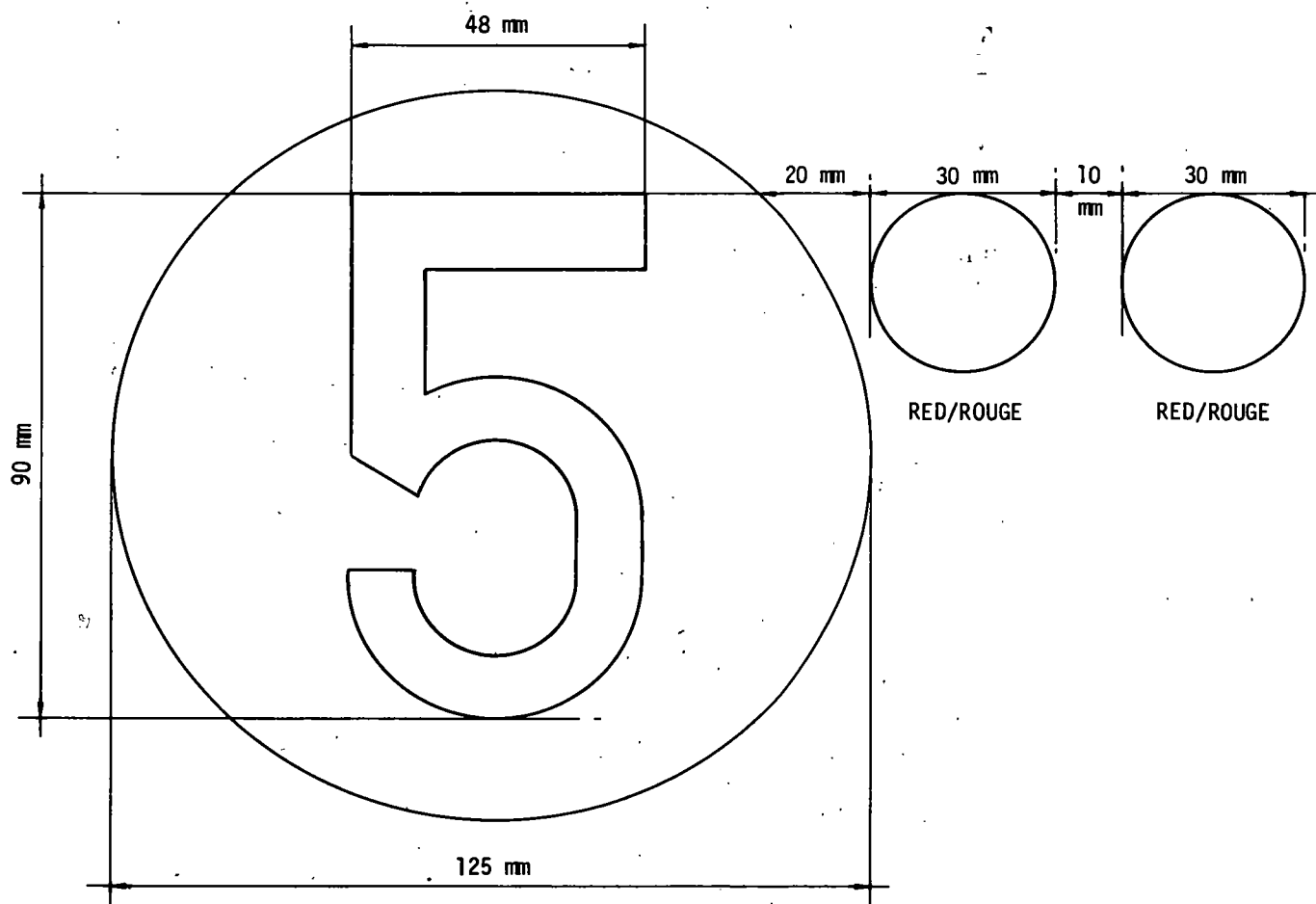
Couleur - Chiffre foncé sur fond blanc.

OTAN - NON CLASSIFIE
D(DofA)-1/D(MdeA)-1

*Figure H-2. MARKING OF HEAVY MILITARY
VEHICLE OF CATEGORIES 4, 5, 6, 7, & 8.*

NATO - UNCLASSIFIED

ANNEX/ANNEXE E
of/du STANAG 2153MARKING OF HEAVY MILITARY VEHICLES OF CATEGORIES
5.2 and 7.2MARQUAGE DES VEHICULES MILITAIRES LOURDS DES CATEGORIES
5.2 et 7.2Figures 5.2 or 7.2
according to the
categoryChiffres 5.2 ou 7.2
suivant la catégorieColour - Dark figure on white background.Couleur - Chiffre foncé sur fond blanc.OTAN - NON CLASSIFIE
E(DoFA)-1/E(MdeA)-1Figure H-3. MARKING OF HEAVY MILITARY
VEHICLES OF CATEGORIES 5.2 AND 7.2.

NATO UNCLASSIFIEDMARKING OF HEAVY MILITARY VEHICLESLOADING ON PPI GAUGEMARQUAGE DES VEHICULES MILITAIRES ENGAGEANT OU
POUVANT ENGAGER LE GABARIT PPIOTAN NON CLASSIFIE
F(DofA)-1/F(MdeA)-1

*Figure H-4. MARKING OF HEAVY MILITARY
VEHICLES LOADING ON PPI GAUGE.*

APPENDIX I

STANAG 2156

TRANSPORTATION REQUEST AND REPLY TO TRANSPORT REQUEST

Agreed English/French Texts

STANAG 2156

DETAILS OF AGREEMENTTRANSPORT REQUEST AND REPLY TO TRANSPORT REQUEST

- Enclosures: I. Annex 'A'—TRANSPORT REQUEST and Appendices 1 and 2.
 II. Annex 'B'—REPLY TO TRANSPORT REQUEST and Appendices 1 and 2.

INTRODUCTION

1. When a unit or formation has to effect a movement for which:—
 - a. it does not possess appropriate means of transport,
 - b. it has inadequate means of transport,
 - c. it cannot use its own means of transport,
 such a unit or formation must prepare a TRANSPORT REQUEST and submit it to the headquarters concerned (Movements and Transport Staff) in accordance with national instructions and international agreements in force.
2. The TRANSPORT REQUEST will be prepared either:—
 - a. by the unit or formation requiring transport,
 - b. or, in urgent cases, by the military commander ordering the movement or transport.
3. The headquarters concerned (Movements and Transport Staff) which receives the TRANSPORT REQUEST should find in it ALL the information necessary to enable it to determine quite independently:—
 - a. the most suitable means of transport, in relation to the requirements and the actual transport available;
 - b. the action necessary to organize the transport or the movement.
4. The headquarters concerned (Movements and Transport Staff), when it has considered the Transport Request, will send the unit or formation a reply in the form of a REPLY TO TRANSPORT REQUEST. The Reply to a Transport Request:—
 - a. is used for the purpose of giving the requesting unit or formation a reply as soon as possible so that it may make the preparations for the movement or transport in question;
 - b. may be circulated as an integral part of (or as an annex or supplement to) the Movement Order issued by the authorities responsible;
 - c. does not preclude the submitting of a "Movement Credit" request on the routes where it is required (in accordance with STANAG 2151).

AGREEMENT

5. In order to standardize the information to be incorporated in the TRANSPORT REQUEST and REPLY TO TRANSPORT REQUEST, the NATO Armed Forces agree to comply with instructions in paragraphs 7 and 8 below when preparing such forms. It is further agreed:—

- a. that these documents must be capable of transmission, in code form, by message or telephone;
- b. that it is not necessary to standardize the layout and format of the forms used for TRANSPORT REQUEST and REPLY TO TRANSPORT REQUEST.

6. If the TRANSPORT REQUEST is for a troop or supply movement by Air and is approved by the proper authority, the Movements Staff concerned will transcribe the requirement onto a form NATO Request for Air Transport (NARAT) in accordance with STANAG 3093.

THE TRANSPORT REQUEST

7. The TRANSPORT REQUEST will give the information called for in the example shown at ANNEX 'A'.

- a. The FIRST Part must be completed in full.
- b. The SECOND, THIRD, FOURTH and FIFTH Parts will be filled in as necessary. Unused spaces will not be taken up subsequently. It is therefore UNnecessary to give nil returns.
- c. Examples:—
 - (1) for the movement of an Infantry Battalion see Appendix 1 to ANNEX 'A';
 - (2) for the transport of a general cargo see Appendix 2 to ANNEX 'A'.

THE REPLY TO TRANSPORT REQUEST

8. The REPLY TO TRANSPORT REQUEST will provide the information listed in the example at ANNEX 'B'.

- a. The FIRST Part must be completed in full.
- b. The other parts will be filled in as necessary. Unused spaces will not be taken up subsequently. It is therefore UNnecessary to give nil returns.
- c. Examples are given at Appendices 1 and 2 to ANNEX 'B'.

ANNEX 'A' to STANAG 2156

TRANSPORT REQUEST

CODE		MEANING	REMARKS
(a)	(b)	(c)	(d)
FIRST PART			
ONE		Very brief description of operation	
TWO		Priority category	If known
THREE		Headquarters concerned (Movements and Transport Staff), unit or service submitting Transport Request	Add: a. rank, name and appointment of officer signing transport request b. address and Tel. No.
FOUR		Security Classification, Reference No. and "Date-time" group given to Transport Request by	

CODE		MEANING	REMARKS
(a)	(b)	(c)	(d)
		requesting authority mentioned in FIRST PART THREE	
FIVE		Departure point of transport	Exact position and coordinates
SIX		"Date-time" group of possible start of embarkation or loading operation.	Indicate Time Zone
SEVEN		Destination of transport	Exact position and coordinates
EIGHT		"Date-time" group by which it is desirable that the transport should reach its destination	Indicate Time Zone
NINE		Means of transport desired	Use the following code:— RED: for road transport BLACK: for rail transport BLUE: for inland waterways GREEN: for sea transport YELLOW: for air transport
TEN		Has the agency requesting transport a metal field loading ramp?	Answer YES or NO
ELEVEN		Any further information considered to be of use.	

SECOND PART

ONE	ALPHA	Male personnel to be transported: — A/B/C	A = number of officers B = number of Sergeants (or equivalent ranks) and above C = number of Corporals (or equivalent ranks) and below
	BRAVO	Female personnel to be transported: — A/B/C	A, B and C as for SECOND PART ONE ALPHA
TWO		Personnel baggage, dress, personal weapons, etc.	Brief description
THREE		Officer commanding personnel during movement	Give: rank, name
FOUR	ALPHA	Animals: A/B	A = kind B = number
	BRAVO	etc.	

THIRD PART

ONE		TANKS AND TRACKED VEHICLES	
	ALPHA	<u>Re first category of vehicles</u> A/B/C/D	A = official description B = number to be moved C = weight in tons D = military class
	BRAVO	E = a x b x c <u>centimeters or inches</u>	a = overall length b = overall width c = overall height

CODE		MEANING	REMARKS
(a)	(b)	(c)	(d)
			(cm for centimetres, in for inches) Where a detail is not known the word 'BLANK' will be inserted; in this way, it will always be possible to identify the data given
	CHARLIE DELTA	<u>Re second category of vehicles</u> A/B/C/D E	{ As above
	ECHO FOXTROT	<u>Re third category of vehicles</u> A/B/C/D E etc.	{ As above
TWO ALPHA		ARTILLERY <u>Re first category</u> A/B/C	A = official description B = number to be moved C = weight in tons a = overall length b = overall width c = overall height Insert the word 'BLANK' where any detail is not known
	BRAVO	D = a x b x c centimetres or inches (cm or in)	
	CHARLIE DELTA	<u>Re second category</u> A/B/C D	{ As above
	ECHO FOXTROT	<u>Re third category</u> A/B/C D	{ As above
THREE		WHEELED MOTOR VEHICLES	
	ALPHA BRAVO	<u>Re first category of vehicles</u> A/B/C/D E	As for tanks (THIRD PART ONE above)
	CHARLIE DELTA	<u>Re second category of vehicles</u> A/B/C/D E etc.	As above
ZULU		Number of motor-cycles	
FOUR		TRAILERS	
	ALPHA BRAVO	<u>Re first category of trailers</u> A/B/C/D E	As for tanks (THIRD PART ONE above)
	CHARLIE DELTA	<u>Re second category of trailers</u> A/B/C/D E etc.	As above
	YANKEE	Type of tractor necessary for trailers with no tractor vehicle	Allow the authority to which the request is submitted to settle this problem, if a road movement is prescribed

CODE		MEANING	REMARKS
(a)	(b)	(c)	(d)
FIVE		TROOPS, MISCELLANEOUS EQUIPMENT, SUPPLIES, ETC. (WHICH CANNOT BE LOADED IN THE UNIT'S OWN TRANSPORT)	
	ALPHA	Personnel: A/B/C	A = number of officers B = number of Sergeants (or equivalent ranks) and above C = number of Corporals (or equivalent ranks) and below
	BRAVO	A/B for first category of cargo	A = brief description of cargo B = weight (in tons)
	CHARLIE etc.	A/B for second category of cargo	As above

FOURTH PART

ONE		GENERAL CARGO—FIRST TYPE	
	ALPHA	Brief description	
	BRAVO	Weight	in tons
	CHARLIE	Average dimensions of items:— a x b x c <u>centimetres</u> or <u>inches</u>	1) State cm for centimetres, in for inches. 2) a = length b = width c = height
	DELTA	Loading capability of sender: A	A = tons per hour
	ECHO	Unloading capability of receiving unit: A	A = tons per hour
	FOXTROT GOLF	Special precautions desired Brief description of heavy or awkward lifts.	
TWO		GENERAL CARGO—SECOND TYPE	
	ALPHA BRAVO CHARLIE DELTA ECHO FOXTROT GOLF	As for FOURTH PART ONE	

FIFTH PART

	ALPHA	Requests for procuring of special means of transport	
	BRAVO	Items or convoys requiring an escort which the unit itself is unable to provide	
	CHARLIE	Any further information considered to be of use	

Note: The FIRST Part of this format must be completed in full. The SECOND, THIRD, FOURTH and FIFTH Parts to be filled in as necessary.

APPENDIX 1 to ANNEX 'A'
to STANAG 2156

MESSAGESECRET

FROM : COMMANDER 12 INF BN

FOR : ACTION : COMMANDER MCG/INTERURGENT OPS
INFO : COMMANDER F INTER ROUTINE

SUBJECT : TRANSPORT REQUEST

FIRST

ONE : MOV OF 12 INF BN OVER DISTANCE OF
250 KM

THREE : COMMANDER 12 INF BN MAJOR JEAN S3
KLEMSKERKE EDEN CINEMA TEL. OS-
TEND 46521

FOUR : SECRET 982 OF 120730 Z

FIVE : KLEMSKERKE ES 0177

SIX : 122200 Z

SEVEN : VERVIERS GS 0408

EIGHT : 140600 Z

NINE : BLACK

TEN : NO

SECOND

ONE : A 40 + B 116 + C638

TWO : KITBAG/BATTLE DRESS

THREE : CAPT. LOUIS

THIRD

ONE ALPHA : CARRIER 81 MM MORTAR MT/8/8/8
BRAVO : 638 x 223 x 227 CM
CHARLIE : CARRIER HT M9/10/8/9/
DELTA : 618 x 221 x 228 CM

THREE ALPHA : JEEP/50/2/2/
BRAVO : 69 x 55 x 70 IN
CHARLIE : AMBULANCE/2/5/5
DELTA : 590 x 213 x 264 CM
ECHO : VAN BAN/10/3/4
FOXTROT : BLANK
GOLF : LORRY 3T/60/8/10
HOTEL : 567 x 230 x 310 CM
INDIA : TRUCK MED WRECKER/3/18/15
JULIET : 310 x 9.7 x 103 IN
ZULU : 22

FOUR ALPHA : TRAILER 250 KG 2-WHEEL/17/1/1/
BRAVO : 109 x 56-40 IN
CHARLIE : TRAILER 1 T 2-WHEEL/30/1/1/
DELTA : 380 x 220 x 217 CM

FIVE BRAVO : RESERVE FOOD SUPPLIES/15 T
CHARLIE : INF AMMO/5 T

APPENDIX 1 to ANNEX 'A'
to STANAG 2156

MESSAGESECRET

FROM : CMP OSTEND—NIEUWPOORT
 FOR : ACTION : COMMANDER MCG/INTER URGENT OPS
 INFO : COMMANDER 10 AMMO ROUTINE
 DEPOT

SUBJECT : TRANSPORT REQUEST

FIRST

ONE : TRANSPORT OF AMMUNITION
 THREE : CMP OSTEND LT COL BAUDRIER S3 HO-
 TEL COSMOPOLITE OSTEND
 TEL. 65232
 FOUR : SECRET 2155 OF 120830 Z
 FIVE : PORT NIEUWPOORT—BASSIN DES PE-
 CHEURS DS 8276
 SIX : 131000 Z
 SEVEN : 10 AMMO DEPOT HOUTHULST DS 9746
 NINE : RED
 TEN : YES

FOURTH

ALPHA : INF AND ARTY AMMO
 BRAVO : 400 T
 CHARLIE : 80 × 40 × 30 CM
 DELTA : 50 T/HR
 ECHO : 60 T/HR

ANNEX 'B' to STANAG 2156REPLY TO TRANSPORT REQUEST

CODE		MEANING	REMARKS
(a)	(b)	(c)	(d)

FIRST PART

ONE		Security Classification, Reference No. and "Date-time" group of transport request to which this reply relates	
TWO		Security Classification, Reference No. and "Date-time" group allocated to this reply by sender	
THREE		Means of transport allocated	Use the following code: RED: road BLACK: rail BLUE: inland waterway GREEN: sea YELLOW: air
FOUR		Complete statement of means of transport allocated	

CODE		MEANING	REMARKS
(a)	(b)	(c)	(d)
FIVE		Rank, name and appointment of officer by whom this reply is signed	
SIX		Any additional information considered useful	

SECOND PART

ONE		Exact location of transport allocated	Identification and coordinates
TWO		"Date-time" group when embarkation or loading operations can begin	Indicate Time Zone. If necessary, break down into ALPHA, BRAVO, CHARLIE etc., if transport availability is spaced out over a period of time
THREE		Expected approximate "Date-time" group of departure of loaded movement or transport	Particularly important in the case of rail movements. Indicate Time Zone
FOUR		Route	Only for road or inland waterway movement or transport
FIVE		Place of disembarkation or unloading	Identification and coordinates
SIX		Any information considered useful	

THIRD PART

ONE		Any information regarding waiting or transit areas; points of first destination, etc.	If necessary, break down into ALPHA BRAVO, etc.
TWO		Special instructions: standards of marching, lighting, blackout line etc.	As above
THREE		Comments regarding control and regulating of movements	As above

NOTE: The FIRST Part of this format must be completed in full.
The other Parts will be filled in as necessary.

APPENDIX 1 to ANNEX 'B'
to STANAG 2156

REPLY TO TRANSPORT REQUEST

MESSAGESECRET

FROM : COMMANDER MCG/INTER
 FOR : ACTION : COMMANDER 12 INF BN
 INFO : COMMANDER F INTER
 SUBJECT : REPLY TO TRANSPORT REQUEST

FIRST

ONE : YOUR SECRET 982 OF 120730 Z
 TWO : SECRET 551 OF 12 1100 Z
 THREE : RED EXCEPT FOR YOUR THIRD PART ONE
 AND THIRD PART FIVE WHICH WILL USE
 BLACK
 FOUR : 12 15METRE FLAT WAGONS AND 5 12T
 CLOSED WAGONS
 FIVE : MAJOR JACQUES S3

SECOND

ONE : OSTEND MARITIME STATION DS 9775
 TWO : 130200 Z
 THREE : 130600 Z
 FIVE : VERVIERS EAST STATION GS 0409

THIRD

TWO : RAMPS AVAILABLE AT OSTEND AND VER-
 VIERS
 THREE ALPHA : FOR YOUR RED MOVEMENT, YOU SHOULD
 APPLY FOR MOVEMENT CREDIT THROUGH
 NORMAL CHANNELS
 BRAVO : BLACK MOVEMENT CAN BE CONTACTED
 VIA RTO GAND ST PIERRE AND LOUVAIN

APPENDIX 2 to ANNEX 'B'
to STANAG 2156

REPLY TO TRANSPORT REQUEST

MESSAGESECRET

FROM : COMMANDER MCG/INTER
 FOR : ACTION : CMP OSTEND-NIEUWPOORT
 INFO : COMMANDER 10 AMMO DEPOT
 URGENT OPS
 URGENT

SUBJECT : REPLY TO TRANSPORT REQUEST

FIRST

ONE : YOUR SECRET 2155 OF 120830 Z
 TWO : SECRET 558 OF 12 1345 Z
 THREE : RED
 FOUR : 20 5T CIVILIAN LORRIES FOR 4 UNINTER-
 RUPTED TRIPS
 FIVE : MAJOR JACQUES S3
 SIX : THESE CIVILIAN VEHICLES WILL BE PRO-
 VIDED BY OTR FURNES TEL. 216.29—GA-
 RAGE MODERNE—55, RUE DE LA GARE

SECOND

ONE : NIEUWPOORT—MARCHE AUX GRAINS—DS
 8276
 TWO : 130900 Z
 THREE : 13 1300 Z/13 1800 Z/13 2300 Z/14 0400 Z
 FOUR : PERVYSE/DIKSMUIDE/KLERKEN/HOUTH-
 ULST
 FIVE : 10 AMMO DEPOT HOUTHULST DS 9746

THIRD

ONE ALPHA : SEND REPRESENTATIVE TO MARCHE AUX
 GRAINS NIEUWPOORT TO DIRECT VEHIC-
 LES TO LOADING QUAY
 BRAVO : WHEN MISSION COMPLETED, PLACE
 TRANSPORT AT DISPOSAL OF OTR FURNES
 THREE : ROUTE UNSPECIFIED

APPENDIX J
STANAG 2158
IDENTIFICATION OF MILITARY TRAINS

STANAG 2158
(Edition No. 2)

Agreed English/French Texts.

DETAILS OF AGREEMENT (DofA)
IDENTIFICATION OF MILITARY TRAINS

AGREEMENT

1. The NATO Armed Forces have agreed to adopt the international identification code defined below for the identification of military trains.

BACKGROUND

2. a. A different procedure is used by each NATO nation for the identification of military trains moving within its territory.
b. A national technical code number is used by each civilian railway organization for each individual train. This number, although primarily designed to keep a record of trains, may, however, give some indication as to the train's country of origin. This number is changed when frontiers are crossed and for various reasons it is impossible to contemplate retaining it beyond the frontier of the country of origin.
c. Some countries have thought it necessary, for the benefit of their military authorities, to add a number to the technical code number, indicating thereby the nature of the contents of the train (troops or supplies). This additional number has so far been specially reserved for the use of the military authorities within the nation in question.
3. It was therefore essential that a standardized procedure be defined and that a code number be devised for the use of military authorities, (allied or national), which would remain unchanged throughout the journey across various frontiers and would cause no inconvenience to railway organizations (which would continue to use their technical numbers).

REQUIREMENTS

4. a. The code number, known, as the "International Identification Code for Military Trains" must show in particular:
 - (1) Movement execution priority, for which it has been agreed to adopt three classes, priority number one being the highest and being assigned in exceptional cases only.
 - (2) Country of origin.
 - (3) Date of departure.

- (4) National identification code number; in order to ensure identification of a given train among other trains to which the above information might also apply (as in the case of several trains departing on the same day), a national identification code number (1) should be included at a given position, in the international code.
- (5) Country of destination.
- b. Because of the complexity of the problem, this procedure will be used only for the identification of complete military trains as opposed to individual goods wagons (US Freight Cars). If a train is broken up on the final stage of its journey, only its biggest section may, if appropriate, retain the original number.
- c. In the planning stage of initial movements the priority and the date of departure will be temporarily replaced in the International Identification Code Number by 0 (zero) and 00 (two zeros) respectively. If the priority is unknown, the index 0 will be used and the movement will take place at the lowest priority. The true date of departure will be given by the movements control agency as soon as it is known.

DEFINITION OF THE INTERNATIONAL IDENTIFICATION CODE FOR USE ON MILITARY TRAINS

5. The code will comprise a series of figures, letters or symbols, arranged as follows:

- a. One figure to indicate the movement execution priority.
- b. Two letters to indicate the country of origin (letters indicating the nationality as in STANAG 1059).
- c. Two figures to indicate the day of departure (in the current month).
- d. The national identification code number (1) as assigned by the country of origin.
- e. Two letters to indicate the country of destination.

6. For example:

2 - FR = 07-436239 = NL

identifies a military train as follows:

- a. Movement execution priority is 2.
- b. The country of origin is FRANCE.
- c. The date of departure is 7th of the current month.
- d. The national identification code number ¹ assigned by FRANCE is 436239.
- e. The train contains items for shipment to the NETHERLANDS.

IMPLEMENTATION OF THE AGREEMENT

7. The STANAG will be considered to have been implemented when the necessary orders/instructions putting the procedures detailed in the Agreement into effect have been issued to the forces concerned.

¹ This number is assigned by the military authorities of the country of origin and will provide information as to the nature of the load carried.

APPENDIX K

STANAG 2165

**FORECAST MOVEMENT REQUIREMENTS—RAIL, ROAD,
AND INLAND WATERWAYS**

STANAG 2165

Agreed English/French Texts.

DETAILS OF AGREEMENT (DofA)

FORECAST MOVEMENT REQUIREMENTS—RAIL, ROAD, AND
INLAND WATERWAYS

Annexes: A(DofA). Table of Forecast Movement Requirements—
Rail, Road and Inland Waterways.

AGREEMENT

1. The NATO Armed Forces agree to use the standard format found at Annex A for the "Table of Forecast Movement Requirements—Rail, Road and Inland Waterways".

STATEMENT OF DETAILS

2. Forecast movement requirements

- a. It is to the advantage of military authorities as soon as they have knowledge of their movement (or transport) requirements for a given period of time, to inform the military authority responsible for the organization of movements (or transport) in the originating nation (or in the originating zone in a nation) as soon as possible.
- b. The requesting authority must use the format of the "Table of Forecast Movement Requirements—Rail, Road and Inland Waterways" shown at Annex A(DofA) when forwarding the essential information:
 - (1) Action : To the military authorities of the originating nation (or in the originating zone in a nation) in charge of the organization of movements.
 - (2) Information : To the military authorities concerned of the transitting nation and nation of destination (or the transitting zone and zone of destination in a nation).
- c. Study of the "Table of Forecast Movement Requirements—Rail, Road and Inland Waterways" will allow the military authority in charge of the organization of movements in the originating nation (or in the originating zone in a nation):
 - (1) To carry out a preliminary survey on the possibilities of granting the request;

Classification _____ (1)

TABLE OF FORECAST MOVEMENT REQUIREMENTS-RAIL, ROAD AND INLAND WATERWAYS (Suggested Format)

For the Period of Time from(date) to (2)

FROM (3)
(Requesting Authority)

TO (4)
(Competent Authority of the Originating Nation)

**ANNEX A (DofA) to
STANAG 2165**

FM 55-20

Serial or Line Item	Refer- ence No or Nick name	Consig- nor	AREA/POINT	Consig- nee	AREA/POINT	Nations/ National zones concerned	Type of trans- port pre- ferred	LOADS															Prior- ities	Remarks
			of depar- true + (coordin- ates)		of des- tination + (coordin- ates)			PAX		CARGO			SPECIAL LOADS				Rate of dis- patch	Date move- ment to com- mence	Date move- ment must be com- pleted					
								Number	Type	Cate- gory or Type	Weight	Cube	Number	Weight of each	Class 2021	Class 2153								
	ALFA	BRAVO	CHARLIE	DELTA	ECHO	FOXTROT	GOLF	HOTEL	INDIA	JUL- IET	KILO	LIMA	MIKE	NOVEM- BER	OSCAR	PAPA	QUE- BEC	ROMEO	SIERRA	TANGO	UNIFORM			
ONE																								
TWO																								
THREE																								
FOUR																								
FIVE																								
SIX																								
SEVEN																								
EIGHT																								
NINE																								
TEN																								

Figure K-1. TABLE OF FORECAST MOVEMENT REQUIREMENTS—RAIL, ROAD, AND INLAND WATERWAYS (SUGGESTED FORMAT).

- (2) To take the first steps with the military authorities of the transitting nation and nation of destination (or the transitting zone and zone of destination in a nation) ;
- (3) To select the type of transport to be used ;
- (4) To inform the requesting authority:
 - (a) Of steps taken to satisfy his requests ;
 - (b) Of the movements for which it will be necessary for the requesting authority to make out a "Transport Request" in accordance with the provisions of STANAG 2165.
- d. The "Forecast Movements—Rail, Road and Inland Waterways" must be forwarded, if possible, in writing in at least one of the two official NATO languages. It can also be forwarded by signal or by telephone by using the code identifying the different items and columns. A specimen of the "Forecast Movement Requirements—Rail, Road and Inland Waterways" as transmitted by signal, is enclosed at Appendix 1 to Annex A(DofA).

IMPLEMENTATION OF THE AGREEMENT

3. This STANAG will be considered to have been implemented when the necessary orders/instructions bringing into use the document mentioned in the Agreement have been issued to the forces concerned.

APPENDIX 1 TO ANNEX A(DofA) TO STANAG 2165

TABLE OF FORECAST MOVEMENT REQUIREMENTS

<u>HEADINGS</u>	<u>MEANING</u>	<u>REMARKS</u>
1.	Classification	Enter classification of report as determined by originating agency
2.	Period of Forecast	Enter period of forecast as announced by the appropriate national authority
3.	Requesting Authority	Enter unit designation of organization responsible for submitting, e.g., 97th Signal Group
4.	Competent Authority of the Originating Nation	Enter unit designation of organization directed to receive forecast within origination nation
<u>COLUMN</u>	<u>MEANING</u>	<u>REMARKS</u>
	Serials/or Line Items	Use separate serial or line item number for each shipment forecast
Alpha	Reference Number or Nickname	
Bravo	Consignor	Enter specific shipping agency
Charlie	Location and Coordinates	Enter exact location and coordinates
Delta	Consignee	Enter specific receiving agency

<u>COLUMN</u>	<u>MEANING</u>	<u>REMARKS</u>
Echo	Location and Coordinates	Enter exact location and coordinates
Foxtrot	Nation (National Zones concerned)	Enter National Zones abbreviations as provided in STANAG 1059
Golf	Type of Transport Preferred	Enter preferred mode: TRK, IWW, Rail (see STANAG 2156).
Hotel/	Number and Type Passenger	Enter number of passengers and general description. Personnel are normally listed as troops, patients, civilians, POWs, and such other categories as will assist the movements personnel in selecting the mode of transportation.
Juliet/ Kilo/ Lima	Class of Supply and Tonage	Enter class of supply, estimated tons and cube. The movement programmers are not normally concerned with an inventory of specific items within a class; however, items requiring special handling must be specified in the remarks column so that outstanding characteristics can be readily identified. For example, heavy lifts other than vehicles should be expressed in units, dimensions and tons for each lift.
Mike/ November/ Oscar/ Papa	Special Loads	Enter number of vehicles/tanks to be moved, weight in tons for each, military classification in accordance with STANAGs 2153 (Rail) and 2021 (Road).
Quebec	Rate of Dispatch	Enter tons of cargo or number of vehicles/tanks which can be moved daily (the capacity of the shipping and receiving organization determines).
Romeo	Date Movement to Commerce	Enter earliest date that movement can commence
Sierra	Date Movement must be completed	Enter date movement must be completed
Tango	Priorities	Forecasting organization enter separate priority for each line item/serial
Uniform	Remarks	Enter any information which will assist in planning the move, e.g., heavy lifts, dangerous material, special handling, date on wheeled vehicle and passenger requirements.

APPENDIX 2 TO ANNEX A(DofA)
OF STANAG 2165

MESSAGE (SPECIMEN)
NATO UNCLASSIFIED

FROM : HQ/ADVANCED BASE UK
TO : EMG/CM TPT
SUBJECT : TABLE OF FORECAST MOVEMENT
 REQUIREMENTS—(SURFACE
 RAIL, ROAD AND INLAND WATER-
 WAYS) FOR PERIOD OF 10 JAN TO
 16 JAN 1966

PRIORITY : ROUTINE
ONE ALFA P/156
 BRAVO 3 REPLN BN
 CHARLIE ZEEBRUGGE ES 1486
 DELTA 9 REPL CO
 ECHO MUNSTER MC 0558
 FOXTROT BE/NL/GE
 GOLF RAIL
 HOTEL 200
 INDIA TROOPS
 JULIET BAGGAGE
 KILO 8T
 LIMA 400 CU FT
 MIKE NIL
 NOVEMBER NIL
 OSCAR NIL
 PAPA NIL
 QUEBEC 50 PER DAY
 ROMEO 12 JAN
 SIERRA 15 JAN
 TANGO TWO
 UNIFORM NIL

TWO ALFA S/723
 BRAVO DEPOT 603
 CHARLIE ZEEBRUGGE ES 1486
 DELTA ASP 503
 ECHO MUNSTER MC 0558
 FOXTROT BE/NL/GE
 GOLF RAIL
 HOTEL NIL
 INDIA NIL
 JULIET AMMUNITION
 KILO 5000 T
 LIMA 1500 CU METRES
 MIKE NIL
 NOVEMBER NIL
 OSCAR NIL
 PAPA NIL
 QUEBEC 1000 T/PER DAY
 ROMEO 12 JAN
 SIERRA 16 JAN

	TANGO	TWO
	UNIFORM	NIL
THREE	ALFA	Q/415
	BRAVO	DEPOT 605
	CHARLIE	GEEL FS 4070
	DELTA	SP 505
	ECHO	RHEINDAHLEN LB 1570
	FOXTROT	BE/NL/GE
	GOLF	RAIL
	HOTEL	NIL
	INDIA	NIL
	JULIET	NIL
	KILO	NIL
	LIMA	NIL
	MIKE	10
	NOVEMBER	60T
	OSCAR	40
	PAPA	8
	QUEBEC	2 PER DAY
	ROMEO	12 JAN
	SIERRA	17 JAN
	TANGO	TWO
	UNIFORM	HEAVY LIFT REQUIRED AT DESTINATION

APPENDIX L
STANAG 2171
PROCEDURES FOR MILITARY TRAINS CROSSING FRONTIERS

STANAG 2171

Agreed English/French Texts.

DETAILS OF AGREEMENT (DofA)
PROCEDURES FOR MILITARY TRAINS CROSSING FONTIERS

- Annexes: A. Frontier Crossing Advice (Rail) (FCA (Rail))
 B. Format of "FCA (Rail)" Teletype Message.
 C. Format of "FCA (Rail) ECHO" Teletype Message.
 D. Frontier Crossing Points. (Format only)

AGREEMENT

1. It is agreed that the NATO Army Forces use the procedures laid down in Annexes A to C to facilitate military trains crossing frontiers between NATO countries.

GENERAL

2. The "reply to transport request" (STANAG 2156) informs the units in their capacity as consignors on all the necessary details of a rail movement to be executed.
3. Units are notified in advance by AMOVPER or AMOVMAT (STANAG 2164) of an approaching rail movement.
4. The purpose of the present STANAG is to lay down procedures for transmitting to adjacent movement agencies responsible for the border crossing point on each side of the frontier information which makes possible the timely processing of a military train in the neighbouring country by the military authorities and enables such movement to be passed on and monitored without delay.
5. The processing of movements by the civil railway authorities runs parallel to this military information procedure. Close cooperation between the agencies of the railways and military movement management can therefore ensure that notifications by the military and railway authorities supplement one another and avoid duplication in reporting.
6. On principle the Frontier Crossing Advice (Rail) (FCA(Rail)) should always be transmitted as early as possible; where data is incomplete, missing items may be transmitted in a follow-on report.
7. This STANAG will not apply to the initial movements preplanned in peacetime or to the evacuation of rolling stock.

DEFINITIONS

8. For the purpose of this Agreement the term "Military Trains" is

defined as those complete military trains of personnel and/or materiel which have been allocated an "international identification code number" in accordance with STANAG 2158.

STATEMENT OF DETAILS

9. Formats

- a. The "Frontier Crossing Advice (Rail) (FCA (Rail))" is prepared in one of the official NATO languages. The following formats are to be used:
 - FCA (Rail)—ALPHA, see para 11a, 11b and Annex A and B.
 - FCA (Rail)—ECHO, see para 11c and Annex C.
 - FCA (Rail)—BIS, see para 11d.
 - FCA (Rail)—ECHO-ECHO, see para 11c.
- b. The classification of the message is to be left to the discretion of the originator.
- c. The items on which no information is necessary or which should be omitted for security reasons when the message is transmitted in clear, shall not be mentioned.

10. Movement Agency Responsible for the Border Crossing Point

- a. The military movement agency responsible for the border crossing point:
 - (1) Is responsible for dealing with foreign military movement agencies with regard to outgoing military trains;
 - (2) Is in charge of military trains arriving from abroad;
 - (3) Is to transmit data to the movement agencies concerned via the areas of responsibility by which the train is routed or in whose area of responsibility the train reaches its destination or crosses another frontier.

11. Procedure

- a. The military movement agency of the country of origin (I) responsible for the border crossing, is to notify the military movement agency of the neighbouring country responsible for the border crossing point concerned (II) by means of a FCA (Rail) (Annexes A and B) of any intended rail movement.
- b. The agency concerned of the neighbouring country (II) is to process the incoming FCA (Rail) and is to take such action as is required on the military side for the continuation of the train. It is to notify the movement agency at destination or the consignee or the movement agency of the neighbouring country (III) in case of transit.
- c. After processing, a FCA (Rail)—ECHO reply is to be transmitted to the responsible movement agency of the country of origin (I) (annex C refers) containing the following items:
 - (1) Time of departure after the frontier crossing (I-II);
 - (2) Time of arrival at destination (or at the following border crossing point (II-III));
 - (3) The true offloading station;
 - (4) Miscellaneous (additional information, desired changes, etc.).
- d. In the event of another frontier crossing into a third NATO country (III), the agency of the transit country (II) is to trans-

mit a FCA (Rail)-BIS to the movement agency responsible for the border crossing point in the country concerned.

- e. On completion of processing, the agency of the country of destination (III) is to transmit a FCA (Rail)-ECHO-ECHO to the agency of the transit country (II) and the agency of the country of origin (I).

12. Deadlines for Notification

- a. For normal circumstances, the FCA (Rail) is to be transmitted to the movement agency responsible for the border crossing point in the neighbouring country 48 hours before a train is due at the frontier. In exceptional circumstances this period may be reduced. For movements involving "hazardous freight" or out-of-gauge transports, notification is required earlier.
- b. If several frontiers are to be crossed, the FCA (Rail) is to be dispatched sufficiently early to ensure that the movement agency responsible for the last border crossing point receives the FCA (Rail)-BIS 48 hours before the arrival of the train at the first frontier to be crossed.
- c. These deadlines are minimum requirements and apply to single trains only. Earlier notification is required when groups of trains are involved.

IMPLEMENTATION OF THE AGREEMENT

13. This STANAG will be considered to have been implemented when the necessary orders/instructions have been issued directing the forces concerned to put the content of this Agreement into effect.

ANNEX A (DofA) TO STANAG 2171

FRONTIER-CROSSING ADVICE (RAIL) FCA (RAIL)

From : VerkK COLOGNE Date: 12 Feb 1968
 To : IV/NS UTRECHT
 Info : MOD THE HAGUE—Vervoerswezen (Movements)
 TBO
 Depot LIESHOUT Telex 003065

Code	Meaning	Information
one	<u>Nickname for the movement</u>	Aida 3
two	<u>international identification code number</u>	3-GE-19-56321 NL
three	<u>Number of transport schedule (optional)</u>	
four	<u>consignor</u>	Depot HESEDORF
five	<u>consignee</u>	Depot LIESHOUT
six	<u>personnel</u>	
alfa	1st class 3 persons	1 M, 2 F
bravo	2nd class 21 persons	21 M
seven	<u>material</u>	
	<u>Number of vehicles</u>	47
eight	<u>out of PPI gauge material</u>	
	<u>Number of vehicles</u>	5
nine	<u>other freight</u>	
	<u>tonnage</u>	300 t
ten	<u>train specifications</u>	

	Code	Meaning	Information
	alfa	length of train	—
	bravo	weight of train	—
	charlie	total number of cars	(optional) —
eleven		<u>loading</u>	HESEDORF (NE 132252)
	alfa	station of departure	192015 Z Feb 68
	bravo	time of departure	
twelve		<u>1st frontier</u>	
	alfa	transfer station	VENLO
	bravo	time of arrival	201125 Z Feb 68
	charlie	time of departure	
		<u>2nd frontier</u>	
	delta	transfer station	
	echo	time of arrival	
	foxtrot	time of departure	
thirteen		<u>offloading</u>	
	alfa	station of destination (proposed)	
	bravo	station of destination (true)	EINDHOVEN (FS 732999)
	charlie	time of arrival	
fourteen		<u>various remarks</u>	
	alfa		drag damaged M47 by salvage crane
	bravo		
	charlie		
fifteen		<u>person commanding personnel during movement</u>	Lieutenant Colonel "X"

APPENDIX 1 TO ANNEX A(DofA) TO STANAG 2171 EXPLANATION CONCERNING ANNEX A

three		Number of transport schedule may be entered at discretion.	
six		Differentiate by "M" for male and "F" for female.	
seven		Differentiate in broad categories only.	
eight			
nine			
ten			
		Since definite train specifications (length of train, weight of train, total number of cars) will not be available before the departure of the train, they should not be requested save for exceptional cases when they are actually required.	
eleven	alfa	To facilitate identification it is expedient to designate the loading and/or offloading station by both name and coordinates (six digits).	
thirteen	bravo		
thirteen	charlie		
twelve	alfa	Designation of the frontier-crossing station may be either by name plus coordinates or by reference to the list of border crossing points.	
	delta		
twelve	charlie	Time of departure after crossing station	cannot be entered before receipt of RCA (Rail)-ECHO
	foxtrot		
thirteen	bravo	Actual station of destination	
thirteen	charlie	Time of arrival at destination	

ANNEX B(DofA) TO STANAG 2171FCA (RAIL)FORMAT OF A TELETYPE MESSAGE

From : Verkk COLOGNE 12 09 50 Z Feb 68
 To : IV/NS UTRECHT
 Info : MOD THE HAGUE—Vervoerswezen (Movements)
 TBO
 Depot LIESHOUT Telex 003065
 WBK III—Verk

one Aida—3
 two 3—GE—19—56321—NL
 four Depot HESEDORF
 five Depot LIESHOUT
 six alfa 1 M, 2F
 bravo 21 m,
 seven 47
 eight 5
 nine 300 t
 eleven alfa HESEDORF (NE 132252)
 bravo 192015 Z Feb 68
 twelve alfa GE—NL 66
 bravo 201125 Z Feb 68
 thirteen alfa EINDHOVEN (FS 732999)
 fourteen Drag damaged M 47 with salvage crane

ANNEX C(DofA) TO STANAG 2171FCA (RAIL)—ECHOFORMAT OF A TELETYPE MESSAGE

From : IV/NS UTRECHT 131530 Z Feb 68
 To : Verkk COLOGNE
 Info : MOD THE HAGUE—Vervoerswezen (Movements)
 TBO
 Depot LIESHOUT Telex 00 30 65
 subject 3—GE—19—56321—NL
 twelve charlie 201200 Z Feb 68
 thirteen bravo equal thirteen alfa
 charlie 201930 Z Feb 68
 fourteen agreed

FRONTIER—CROSSING POINTS

CROSSING POINTS ¹													
Serial No. of Crossing Point	Military Route No.	Road Movement HQ—District	Rail Identifi- cation Marks	Rail Movement HQ—District	COUNTRY	Location add coord- inates if necessary	COUNTRY	Location add coord- inates if necessary	Rail Movement HQ District	Rail Identifi- cation Marks	Road Movement HQ—District	Military Route No.	REMARKS
a	b	c	d	e	f	g	h	i	k	l	m	n	o

¹: Indicate a clearing station with an asterisk* in column g or i.

APPENDIX M
STANAG 2172
CLASSIFICATION AND MARKING OF ORDINARY FLAT
WAGONS USED FOR THE TRANSPORT OF MILITARY VEHICLES

Agreed English/French Texts.

STANAG 2172

DETAILS OF AGREEMENT (DofA)

CLASSIFICATION AND MARKING OF ORDINARY FLAT WAGONS
USED FOR THE TRANSPORT OF MILITARY VEHICLES

Annex : A(DofA). Classification of ordinary flat wagons.
 : B(DofA). Marking of ordinary flat wagons.

AGREEMENT

1. The NATO Armed Forces agree to classify ordinary flat wagons used in Continental Western Europe for the transport of their light and medium weight vehicles in accordance with the provisions of Annex A(DofA) and to have them marked in accordance with Annex B(DofA), it being understood that these operations will be carried out in agreement with the Railway Administrations which own the wagons.

GENERAL

2. Need for a Classification of Railway Flat Wagons. The transport by rail of light and medium-weight military vehicles generally presents considerable difficulty because of the great variety of characteristics of these vehicles and the need to use the correct type of flat wagon in each case. Furthermore, in many cases, these loads exceed the loading gauge of the railways (see STANAG 2805-E, Annex B(DofA)). With a view to simplifying the preliminary study necessary for each of these movements, facilitating selection of the wagons required and the checking of loading by supervisory personnel and to speed up clearance from loading points, as well as the actual movement some Railway Administrations have classified their ordinary flat wagons into four categories. This classification also applies to wagons belonging to the Armed Forces stationed in the ACE area. Wagons of each of these categories suitable for carrying military vehicles are easily identified by means of a special mark.

DEFINITIONS

3. The following definitions are used for the purpose of this Agreement:
- a. Ordinary Flat Wagons. Ordinary flat wagons (in the military sense of the term) are those with characteristics corresponding to one of the categories listed in Annex A(DofA) and which are suitable for the conveyance of light and medium-weight military vehicles.

- b. Light and Medium-weight Military Vehicles. The military vehicles covered by this document are wheeled vehicles of less than 20 metric tons¹ overall weight. Some vehicles may constitute out of gauge loads, especially in height; special arrangements have to be made for their movement.

STATEMENT OF DETAILS

4. Classification and Marking of Ordinary Flat Wagons

- a. Basis of Classification. The classification of ordinary flat wagons into categories was carried out after a comparative study of the characteristics of wagons belonging to the Railway Administrations of Belgium, Denmark, France, the Federal Republic of Germany, Italy, Luxembourg and the Netherlands.
The characteristics taken into account were:
 - (1) Carrying capacity
 - (2) Usable length
 - (3) Usable width
 - (4) Load in relation to the length of the bearing surface (minimum strength over a given bearing length).
- b. Classification. The classification table for ordinary flat wagons is given at Annex A(DofA).
- c. Miscellaneous Comments Concerning the Classification
 - (1) In general, there is no objection to the loading of two or more vehicles on the same wagon, provided the overall load does not exceed the authorized limits (see Annex A(DofA)—column (f) and (g)) and the vehicles are far enough apart to allow them to be correctly secured.
 - (2) Graduation. A graduation of the characteristics of all wagons enables a wagon of this category to be replaced by another in a higher category.
However, although possible, it is not desirable to replace ordinary flat wagons (categories 0 to 3) with special flat wagons (categories 4 to 8) — (See STANAG 2153).
- d. Military Marking of Ordinary Flat Wagons. Ordinary flat wagons bear marks the shape, dimensions, position and colours of which are defined in Annex B(DofA).

IMPLEMENTATION OF THE AGREEMENT

- 5. This STANAG will be considered to have been implemented when the necessary orders/instructions to adopt the method described in this Agreement have been issued to the forces concerned.

¹ The corresponding value of one metric ton is considered to be 2200 pounds.

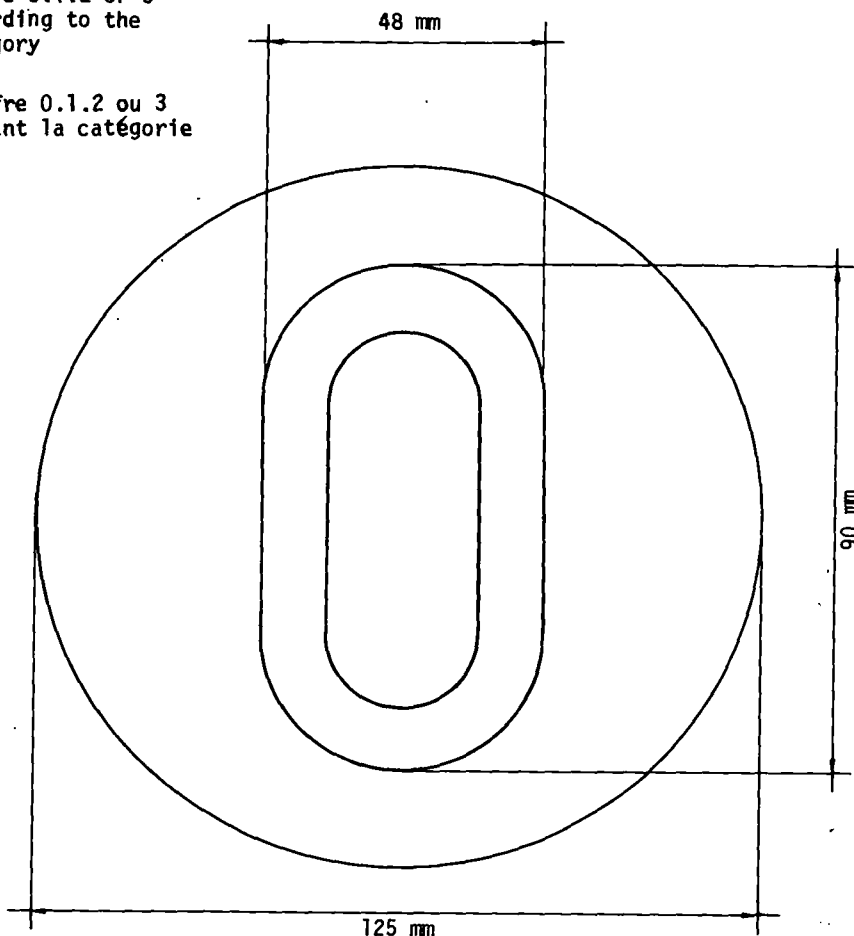
**ANNEX A TO THE DETAILS OF AGREEMENT
OF STANAG 2172**

CLASSIFICATION OF ORDINARY FLAT WAGONS

Characteristics of wagons					Limiting weight and length of vehicle or vehicle group to be loaded	
Category	Carrying capacity (C)	Length (L)	Width (1)	Minimum strength over a given bearing length (P)	Total weight (T) (including load)	Length (L)
(a)	(b)	(c)	(d)	(e)	(f)	(g)
0	$C < 20 \text{ t}$	$L \geq 9 \text{ m}$	$1 \geq 2.47 \text{ m}$	$P \geq 5 \text{ t}/2.50 \text{ m}$	$T \leq 15 \text{ t}$	$L \leq 7 \text{ m}$
1	$C \geq 20 \text{ t}$	$L < 9 \text{ m}$	$1 \geq 2.47 \text{ m}$	$P \geq 10 \text{ t}/2.50 \text{ m}$	$T \leq 20 \text{ t}$	$L \leq 7 \text{ m}$
2	$C \geq 20 \text{ t}$	$9 \text{ m} \leq L \leq 12 \text{ m}$	$1 \geq 2.56 \text{ m}$	$P \geq 10 \text{ t}/2.50 \text{ m}$	$T \leq 20 \text{ t}$	$7 \text{ m} < L \leq 9 \text{ m}$
3	$C \geq 20 \text{ t}$	$L > 12 \text{ m}$	$1 \geq 2.77 \text{ m}$	$P \geq 16.5 \text{ t}/2.50 \text{ m}$	$T \leq 20 \text{ t}$	$9 \text{ m} < L \leq 12 \text{ m}$

Important Remarks : (1) Tracked equipment weighing over 10 tons must in principle be loaded on category 3 wagons. When such wagons are not available, authorized concentrated loads must be checked prior to loading.
 (2) The minimum length of vehicles to be loaded on category 2 and 3 wagons has been given to prevent unnecessarily large wagons being ordered for small vehicles.
 (3) All tonnages shown are metric.

NATO UNCLASSIFIED

ANNEX/ANNEXE B
of/du STANAG 2172MARKING OF ORDINARY FLAT WAGONS
MARQUAGE DES WAGONS PLATS ORDINAIRESFigure 0.1.2 or 3
according to the
categoryChiffre 0.1.2 ou 3
suivant la catégorie

- POSITION - On both sides of the body or of the side member, and on the right when facing the wagon.
- Emplacement - Sur les 2 faces latérales de la caisse ou du longeron de châssis, à droite en regardant le wagon.
- Color - Dark figure on white.
- Couleur - Chiffre foncé sur fond blanc.

B(DofA/MdeA) - 1
OTAN NON CLASSIFIE

Figure M-1. MARKING OF ORDINARY FLAT WAGONS.

APPENDIX N

STANAG 2805-E, ANNEX B

CLASSIFICATION OF RESTRICTIONS AFFECTING THE

MOVEMENT OF CERTAIN MILITARY EQUIPMENT BY LAND ON

CONTINENTAL WESTERN EUROPE

ANNEX B (DofA) TO STANAG 2805-E

RAIL MOVEMENTS

Appendixes: 1 to 8 to Annex B (DofA)

LOADING GAUGES

1. A loading gauge exists for railroad transport and has already been covered by international agreement. It is the PPI Gauge (passe-partour international) which is shown on the dimensioned diagram at Appendix 1 to this Annex. (The detailed dimension of the lower parts which do not affect loading conditions are not reproduced on the diagram).
2. A load not exceeding this gauge can travel without limitation on most of the Continental Western Europe lines.
3. A certain number of existing military equipment, heavy or cumbersome, does not come within this gauge when it is loaded on commercial types of waggons adapted to its tonnage.
4. For technical and military reasons it is not always possible to restrict the manufacture of all future equipment to dimensions which are compatible with the limitations of this gauge. In addition, it does not appear to be possible to modify to an acceptable extent the existing rolling stock of the different railroad companies. Although the need to reduce the height is taken into account in the manufacture of new equipment, this is not sufficient because the width of the equipment to be carried affects essentially the infrastructure.
5. Under the conditions of paragraph 4, the PPI gauge is insufficient for the conveying of heavy or cumbersome military equipment which, for this reason, has been called "out-of-gauge equipment".
6. In view of the relatively large number and tactical importance of these equipments it is not possible to:
 - a. Subject them automatically to particular movement regulations which require a preliminary survey of special routes the number which is too restricted and sometimes too difficult to draw up (existing itineraries for "out-of-gauge convoys"), as this would be likely to hinder the movement of ordinary equipment.
 - b. Preclude them deliberately from being conveyed by rail as this would delay considerably their movement to the area when they would be used.

7. The aim has therefore been to find a larger gauge which would enable most of this equipment to be conveyed on existing waggons on the greatest number of itineraries possible though this would entail the carrying out of alternations on the most restricted lines. This gauge which is a compromise between the requirements and capabilities, has been called "TZ gauge" and is shown on the dimensioned diagram at Appendix 2 to this Annex.

8. A line is said to be available for TZ gauge traffic when it satisfies the following conditions:

- a. In the case of a single track line, the TZ gauge must be cleared without restriction throughout its length.
- b. In the case of a double track line, simultaneous movement of TZ gauge and PPI gauge equipment must be possible through its length in any direction without any restriction other than at a few special points where passing is not allowed. Each nation has to take into account the fact that the gauge TZ is defined for a load of a length not exceeding $283 \frac{7}{16}$ " (7.20 metres) on a waggon of the same wheelbase. (The maximum dimensions for the width of a load of different length on a waggon having a different wheel-base are defined further on in the STANAG.)

9. It is very desirable that all the lines of all European networks be able to meet these minimum requirements. In view of the fact that it is not yet so (especially as regards the French and Italian networks), the TZ gauge can only be considered as a limiting gauge for restricted movement.

ADOPTION OF THE TZ GAUGE AS THE LIMITING GAUGE FOR RESTRICTED MOVEMENT

10. The TZ gauge as defined in the dimensioned diagram at Appendix 2 has been agreed as being the limited gauge for restricted movement on the railroad networks of Central Europe, DENMARK and ITALY. However, it is understood that all loads exceeding the gauge normal to each administration will continue to be considered as abnormal load and will be the subject of special consideration by the Railway Administration.

DEFINITION OF THE LIMITING STANDARDS FOR EQUIPMENT

11. The limiting loading gauge having been defined, the limiting standards for equipment depend upon the characteristics of the carrying waggons.

12. Flat waggons have been divided into two groups:

- a. Ordinary Waggons.
- b. Special Wagons.

13. Ordinary wagons form the greater part of the railroad companies' rolling stock. They are of many different types and a parallel classification of waggons and equipment is under study for the European area. However, many of these waggons have the same average characteristics as regards the height of the floor. Standards A and B1 (see para 15) are based on these average standards.

14. Special waggons, although far less numerous are nevertheless classified by the Centre-Europe Committee of PBEIST into 5 categories (document AC/15 (CE)D/45), only four of which (5,6,7, and 8) are of real value for the carrying out of military movements.

15. In terms of the above factors (TZ and PPI gauges and characteristics of waggons) military equipment can be classified in the following 3 groups:

- a. Normal Movement equipment clearing the PPI gauge on ordinary waggons (Group A).
- b. Restricted Movement B1 equipment clear the TZ gauge on ordinary waggons—B2 equipment clearing the TZ gauge on special waggons (Group B).
- c. Difficult or impossible movement equipment exceeding the TZ gauge any type of waggon (Group C).

16. The category "equipment clearing the PPI gauge on special waggons" need not be considered as this case arises very rarely in practice.

17. Owing to the diversity of special waggons, it has been found necessary to divide B2 category "equipment clearing the TZ gauge" (see para 15b.) into three sub-categories.

18. Five limited standards have been defined for the manufacture of equipment likely to be conveyed by rail; these standards correspond to the various types of waggon and were selected in the following way: in each category, those waggons were selected, from among the current types, which imposed the most limiting conditions, so that the standards will be valid, in fact, for a large number of waggons; an essential characteristic of the waggons for movement within the curves is the wheel-base of the waggon; the axis of the outside axles for simple axle waggons and the distance between the pivots of the bogies for waggons constructed with bogies.¹ An off-centre correction is given for each standard; a maximum length has also been laid down for the load. Any load complying with these standards can be moved as a "TZ load" in accordance with the definition given in paragraph 8, on any railroad on which the curve radius is 492 ft (150 metres) or more. Paragraphs 25 and 28 explain how the dimensions of these standards should be reduced in the case of longer loads.

NOTE. On the diagrams and the graph which constitute the Appendices to this Annex, the following code has been used:

- l = width of load
 - lm = maximum width (width between outside edges of tracks)
 - d = width of tracks
 - L = length of load
 - a = wheel-base of waggon (distance between outside axles or pivots of bogies).
- Unless otherwise stated, the measurements given on the diagrams are in millimetres. On the graph, the measurements are in metres.

19. Standard A. This is the standard for equipment clearing the PPI gauge on ordinary waggons (para 15a.) with off-centre correction of 1 9/16" (40 mm). The standard waggon selected is one having a width of 101 3/16" (2.67 m) maximum height of loading floor 50 3/8" (1.28 m) and wheel-base of 315" (8 m); the maximum length and the maximum STANAG class selected are 413 3/8" (10.5 m) and class 12 respectively; this corresponds to what is possible with existing waggons. The diagram of the Standard given in Appendix 3 shows maximum dimensions:

- a. For a wheeled vehicle loaded on to a waggon having 25 5/8" (600 mm) sides.
- b. For a tracked vehicle loaded on to a waggon without sides, it is

¹ This wheelbase is marked "a" on the diagrams.

accepted that the trucks may project sideways by half a width, with a safety margin of 1 31/32" (50 mm).

20. Standard B1. This is the standard for equipment clearing the TZ gauge on ordinary waggons (para 15b.) with off-centre correction of 1 9/16" (40 mm). The standard waggon selected and the maximum length are the same as for Standard A. For Standard B1, see diagram at Appendix 4. It should be noted that since the loading floor is at a height of less than 51 19/32" (1.31 m),² the dimensions of the lower parts of the load (in particular, the width taken between the outer edges of the tracks) do not exceed those of Standard A. (To take account of developments in the waggon pool of the railway companies, a new standard, which could be called B11, is under study; if necessary, it could be introduced in this STANAG in addition to or in place of Standard B1.)

21. Standard B21. This standard relates to equipment clearing the TZ gauge on special waggons (para 15c.) the standard waggon selected is one of the E4 classification. E4 waggons, which constitute category 8 of the PBEIST classification (para 14) all have very similar characteristics, in particular:

width of floor	124" (3.15 m)
height of floor	51 19/32" (1.31 m)
wheel-base	283 7/16" (7.20 m)

On the basis of a maximum length of 283 7/16" (7.20 m) for leading, therefore, the standard "TZ" load defined in para 8 is arrived at. Thus, the only reductions to be made to dimensions of the vehicle in relation to the gauge are those resulting from the loading tolerance; in order to make the fullest possible use of the advantages inherent in these waggons, which are the most useful for the transport of heavy tanks, it has been agreed that loading should be effected with particular care and the off-centre correction has been reduced to 19/32" (15 mm). The diagram of this standard is given in Appendix 5.

22. Standard B22. This standard relates to wheeled equipment clearing the TZ gauge on special waggons of category 5 in the PBEIST classification. The floor width of the majority of these waggons (classification, index E3) is 111 13/32" (2.83 m), the floor height is 50" (1.27 m) and the wheel-base 336" (9.30 m); this is the standard waggon which was selected for the laying down of the standard, accepting a maximum length of load of 433" (11 m) and an off-centre correction of 1 9/16" (40 mm). The diagram of this standard is given in Appendix 6.

23. Standard B23. This standard also relates to wheeled equipment clearing TZ gauge on special waggons. The characteristics of the standard waggon selected are as follows:

maximum height of actual floor	: 53 9/16" (1.36 m)
maximum height on bearing joists	: 57 3/32" (1.45 m)
wheel-base	: 503 15/16" (12.80 m)
maximum load corresponding to STANAG class	: Approximately 30

Such waggons fall into category 4 of the PBEIST classification; they are relatively narrow, often have metal floors and are not generally used in peacetime for the transport of vehicles; they can however be useful in wartime. The standard has been laid down for a maximum length of load of 15 m and an off-centre correction of 1 9/16" (40 mm). The corresponding diagram is given in Appendix 7.

² Level above which the TZ gauge is wider than the PPI gauge.

24. In order to enable military equipment to be transported rapidly and without delay due to a long preliminary study, it is necessary that its transversal measurements be no greater than the standards given above.

25. Details are given below of the exceptions which, in theory, might possibly be made to these standards, but it is pointed out that, in practice, it would be very difficult to benefit from such exceptions. If the stock of special flat waggons of Continental Western Europe were considerably modified, it would be preferable to lay down a new standard allowing for the rationale use of new types of waggons, if the number of these justified such action.

- a. For equipment of a length considerably less than the maximum length referred to in the standards, the widths could be increased as indicated in paragraph 28.
- b. In the same way, if waggons having a shorter wheel-base than that laid down were available, either the length or the width of the load could be increased but this would undoubtedly be even more difficult than in the previous case.

26. It could of course be agreed that auxiliary components of the equipment to be transported be allowed to exceed the limits of the standard, provided they can be either detached or dismantled.

27. All equipment, the transverse dimensions of which exceed the limits of the standards and the conditions laid down in paragraph 25 and 26, would fall into group C (para 15c) and its conveyance by rail would be very problematic in view of the limitations which could be imposed.

28. The graph at Appendix 8 provides a means of determining what modifications as described in paragraphs 25a and 25b can be made to the standards; the graph shows the relationship between the maximum values for the wheelbase of the waggon 'a', the length of the load 'L' and the width of this load '1' found at the widest point of the vertical part of the limited envelope curve.

- a. The graph has been drawn on the hypothesis that the load is centered on the waggon; in practice, therefore, the value 'c' of the off-centre correction must be applied to the value of 1 obtained from the phase:
 - to find the maximum width corresponding to a given width 1, read off from the graph, twice the corresponding correction must be subtracted ($1_m = 1 - 2c$);
 - where the width of the load 1_m is known, the appropriate length L is obtained by adding to this known width twice the off-centre correction, to find the value of 1 to be used on the graph ($1 = 1_m + 2c$).
- b. The width 1, read off from the graph and then reduced by subtraction of the off-centre correction, is that of the lower part of the load; it is, therefore, less than the limit of 3.54 m by an amount 's' ($s = 3.54 - 1 + 2c$):
 - to find the width of the load at a given level, subtract 's' from the corresponding value of the TZ gauge;
 - conversely, where the width of a load at a given level is specified, the difference 's' between this value and the corresponding value of the TZ gauge can be calculated; the width 1 to be used on the graph will be the value of " $3.54 - s$ " to which should be applied the off-centre correction ($1 = 3.54 - s + 2c$).

Appendix 1 to Annex B (DofA)
to STANAG 2805-E

APPENDICE 1 A L'ANNEXE B
(MdeA) AU STANAG 2805-E

PPI (PASSE-PARTOUT INTERNATIONAL) GAUGES/GABARIT PPI

Dimensions shown thus: millimetres (feet-inches)
Les dimensions sont indiquées comme suit:
millimètres (feet-inches)

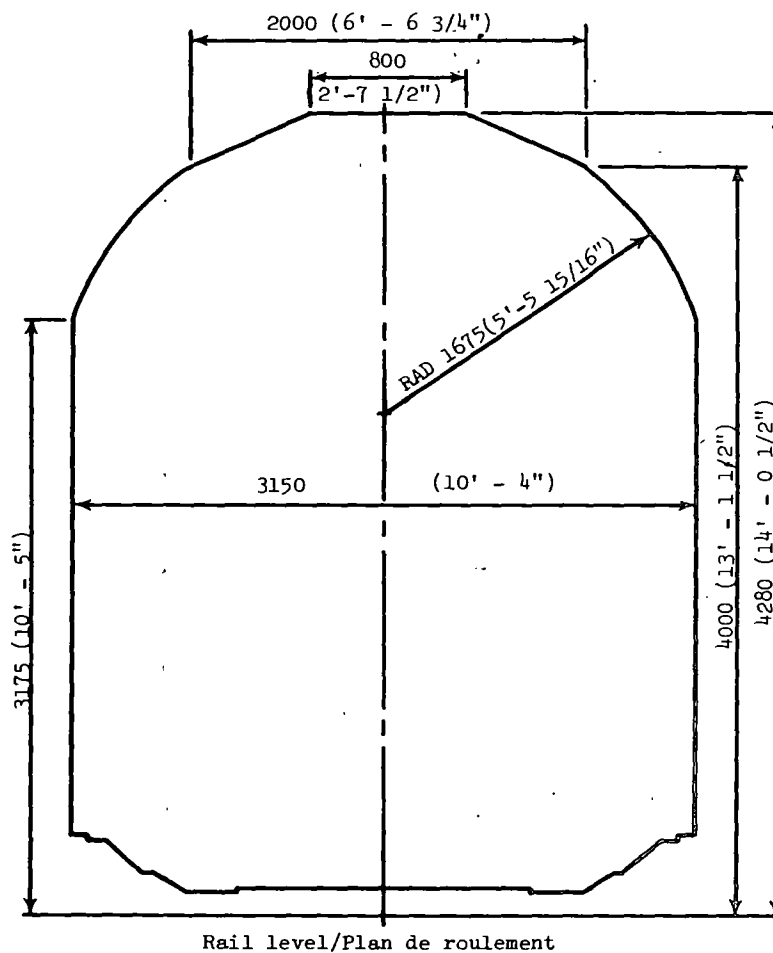


Figure N-1.

Appendix 2 to Annex B (DofA)
to STANAG 2805-E

APPENDIX 2 TO ANNEX B (DofA)
TO STANAG 2805-E

APPENDICE 2 A L'ANNEXE B
(MdeA) AU STANAG 2805-E

TZ GAUGE/GABARIT "TZ"

Dimensions shown thus: millimetres (feet-inches)
 Les dimensions sont indiquées comme suit:
 millimètres (feet-inches)

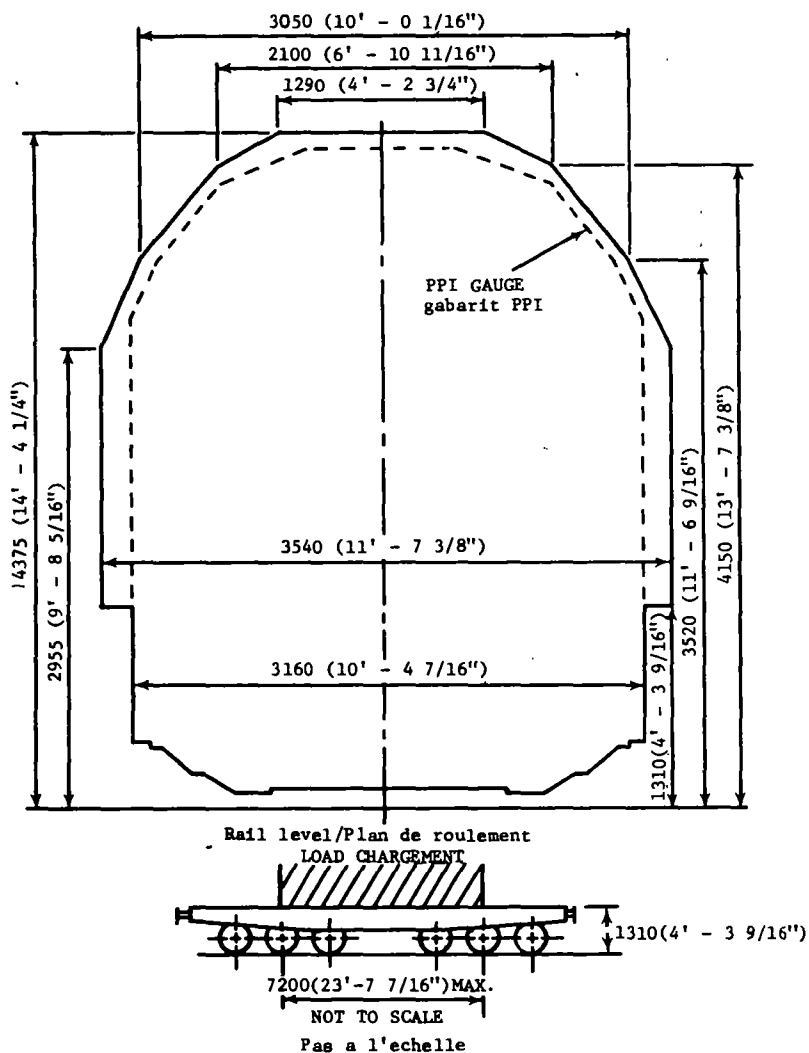


Figure N-2.

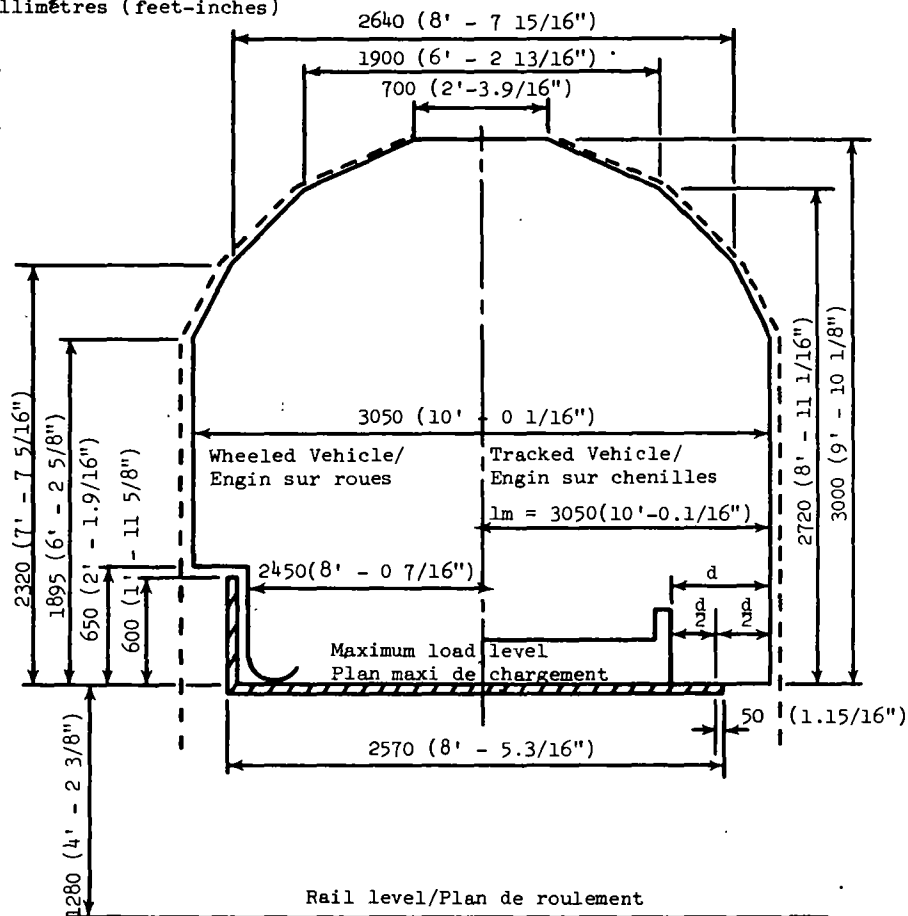
Appendix 3 to Annex B (DofA)
to STANAG 2805-E

APPENDICE 3 A L'ANNEXE B
(MdeA) AU STANAG 2805-E

MANUFACTURE GAUGE FOR MILITARY VEHICLES/GABARIT DE
CONSTRUCTION POUR LES VEHICULES MILITAIRES
STANDARD/NORME A

Dimensions shown thus:
millimetres (feet-inches)
Les dimensions sont indiquées
comme suit:
millimètres (feet-inches)

Off centre correction./ : + 40mm (1.9/16")
Tolerances de centrage : -



Rail level/Plan de roulement

— Manufacture Gauge/Gabarit de construction

- - - P.P.I. Loading Gauge/Gabarit de chargement PPI
maximum length/longueur maxm:
10500mm (34' - 5 3/8")

Maximum STANAG classification: 12 (Approx)
Class STANAG maxi: 12 (approximativement)

- (1) For a tracked vehicle, the maximum width from the outside of the tracks (lm) must not exceed 3050mm (10' - 0.1/16") and must be compatible with $lm < 2570mm + d - 100mm$ (8' - 5.3/16" + d - 3 15/16")
Pour un engin chenillé la largeur maxi prise à l'extérieur des chenilles (lm) ne devra pas dépasser 3050 mm (10' - 0.1/16") et rester compatible avec la formule $lm < 2570mm + d - 100mm$ (8' - 5.3/16" + d - 3 15/16")

d: being the width of a track/
étant la largeur d'une chenille

Figure N-3.

Any component outside this gauge must be capable of being detached or dismantled./

Tout élément dépassant le présent gabarit doit être amovible ou démontable.

Appendix 5 to Annex B (DofA)
to STANAG 2805-E

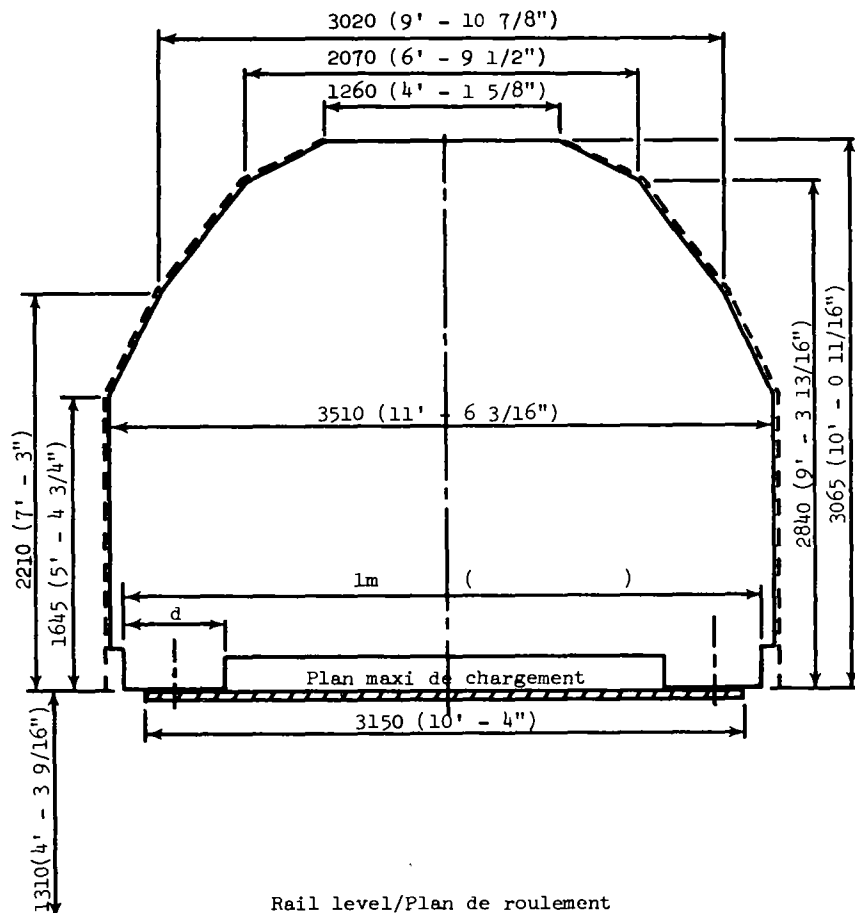
APPENDICE 5 A L'ANNEXE B
(MdeA) AU STANAG 2805-E

MANUFACTURE GAUGE FOR MILITARY VEHICLES/GABARIT DE
CONSTRUCTION POUR LES VEHICULES MILITAIRES
STANDARD/NORME B21

Dimensions shown thus:
millimetres (feet-inches)

Off-centre correction/
Tolerances de centrage : ± 15 mm (19/32")

Les dimensions sont
indiquées comme suit:
millimètres (feet-inches)



— Manufacture Gauge/
Gabarit de construction
- - - Tz Loading Gauge/
Gabarit de chargement Tz

Any component outside this
gauge must be capable of being
detached or dismantled./

Tout élément dépassant le
présent gabarit doit être
rendu amovible ou démontable.

Maximum Length/Longueur Maximum: 7200 mm
(23' - 7 7/16")
Maximum STANAG classification: 70 (Approx)/
Class STANAG maxi: 70 (approximativement)

lm: the maximum width from the outside of the
tracks, must not exceed 3510 mm (11' - 6 3/16")
and must be compatible with the formula:
 $lm \leq 3150 \text{ mm} + d - 100 \text{ mm}$ (10' - 4" + d - 3 15/16")

lm: la largeur maximum prise à l'extérieur des
chenilles ne devra dépasser 3,510 mm et rester
compatible avec la formule:
 $lm \leq 3150 \text{ mm} + d - 100 \text{ mm}$ (10' - 4" + d - 3 15/16")

d: being the width of a track/étant la largeur
d'une chenille

Figure N-5.

**Appendix 6 to Annex B (DofA)
to STANAG 2805-E**

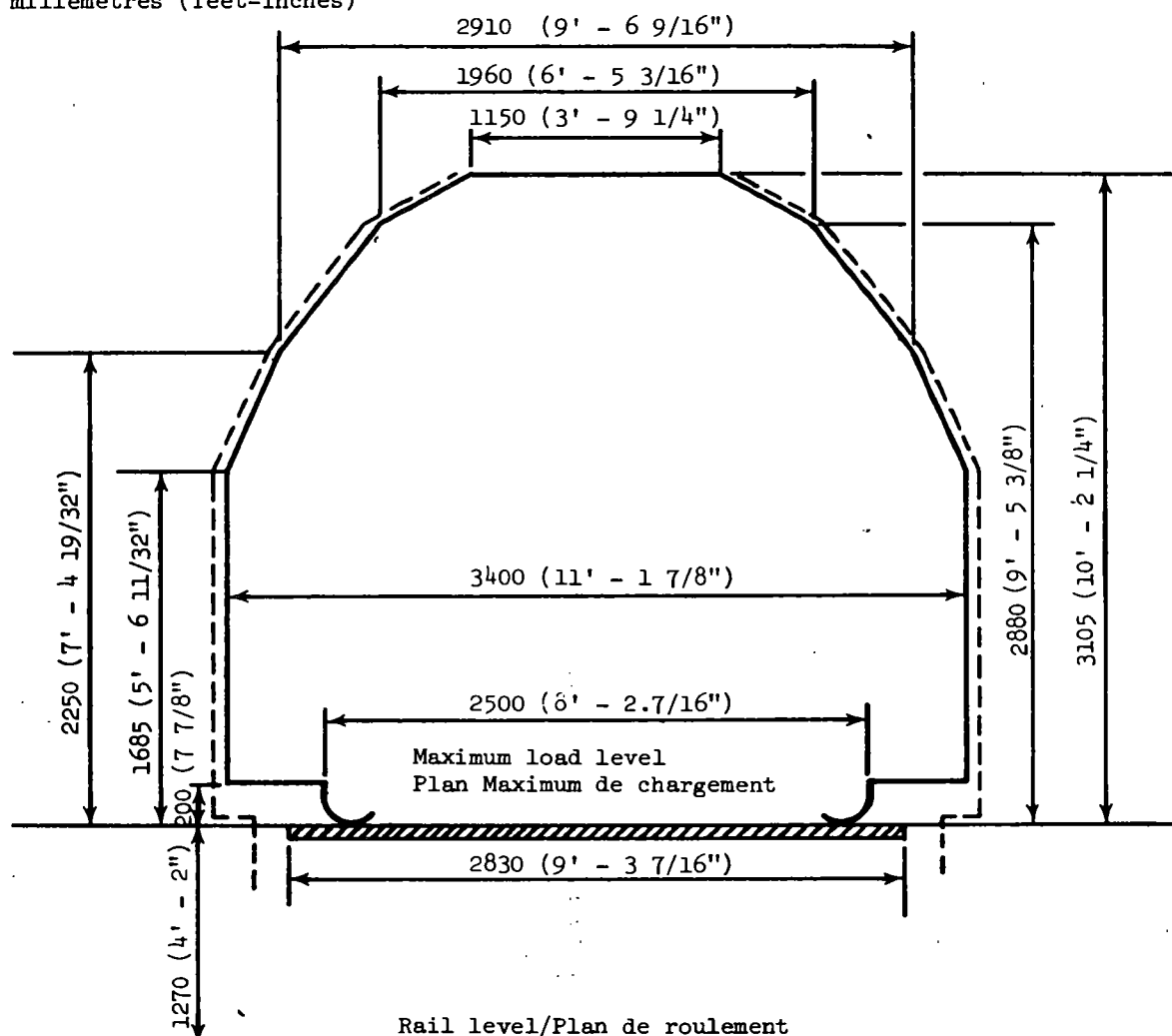
APPENDICE 6 A L'ANNEXE B
(MdeA) AU STANAG 2805-E

**MANUFACTURE GAUGE FOR MILITARY VEHICLES/GABARIT DE
CONSTRUCTION POUR LES VEHICULES MILITAIRES
STANDARD/NORME B22**

Dimensions shown thus:
millimetres (feet-inches)

Off-centre correction/
Tolerances de centrage : + 40 mm (1.9/16")
-

Les dimensions sont WHEELED VEHICLES/VEHICULE SUR ROUES
indiquées comme suit:
millimètres (feet-inches)



Any component outside this
gauge must be capable of being
detached or dismantled.

Tout élément dépassant le
présent gabarit doit être rendu
amovible ou démontable

— Manufacture Gauge/Gabarit de construction

- - - TZ Loading Gauge/Gabarit de chargement TZ
Maximum Length/Longueur Maximum:
11000 mm (36' - 1.1/16")

Maximum STANAG classification: 30 (approx)
Class STANAG maxi: 30 (approximativement)

Figure N-6.

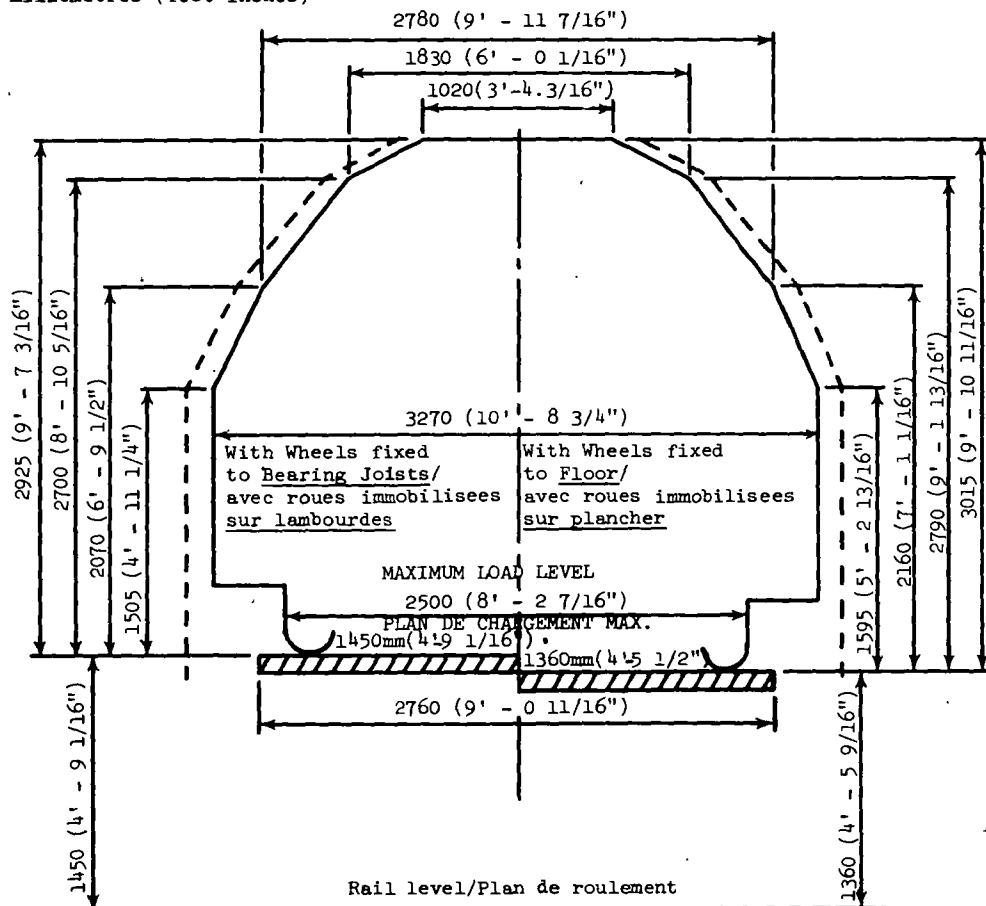
Appendix 7 to Annex B (DofA) to STANAG 2805-E

APPENDICE 7 A L'ANNEXE B (MdeA) AU STANAG 2805-E

MANUFACTURE GAUGE FOR MILITARY VEHICLES/GABARIT DE CONSTRUCTION POUR LES VEHICULES MILITAIRES STANDARD/NORME B23

Dimensions shown thus: Off-centre correction/ : + 40 mm (1.9/16")
millimetres (feet-inches) Tolerances de centrage - 40 mm (1.9/16")

Les dimensions sont WHEELED VEHICLES/VEHICULE SUR ROUES
indiquées comme suit:
millimètres (feet-inches)



— Manufacture Gauge/Gabarit de construction

--- TZ Loading Gauge/Gabarit de chargement TZ
maximum Length/Longueur Maximum 15000 mm
(49' - 2 1/2")

Maximum STANAG classification: 30 (approx)
Class STANAG maxi: 30 (approximativement)

Any component outside this gauge must be capable of being detached or dismantled./

NOTE: The right hand diagram shows the maximum height permissible for the manufacture of a vehicle, which would be loaded on the floor and not on bearing joists./

Tout élément dépassant le présent gabarit doit être rendu amovible ou démontable

NOTA: La 1/2 vue de droite indique les possibilités de hauteurs maxima de construction d'un véhicule dont les points d'appuis sur wagon seraient situés sur le plancher, en dehors des lambourdes.

Figure N-7.

Appendix 8 to Annex B (DofA)
to STANAG 2805-E

APPENDICE 8 A L'ANNEXE B
(MGA) AU STANAG 2805-E

GRAPH/ABOUE

mètres
(feet-inches) ℓ .

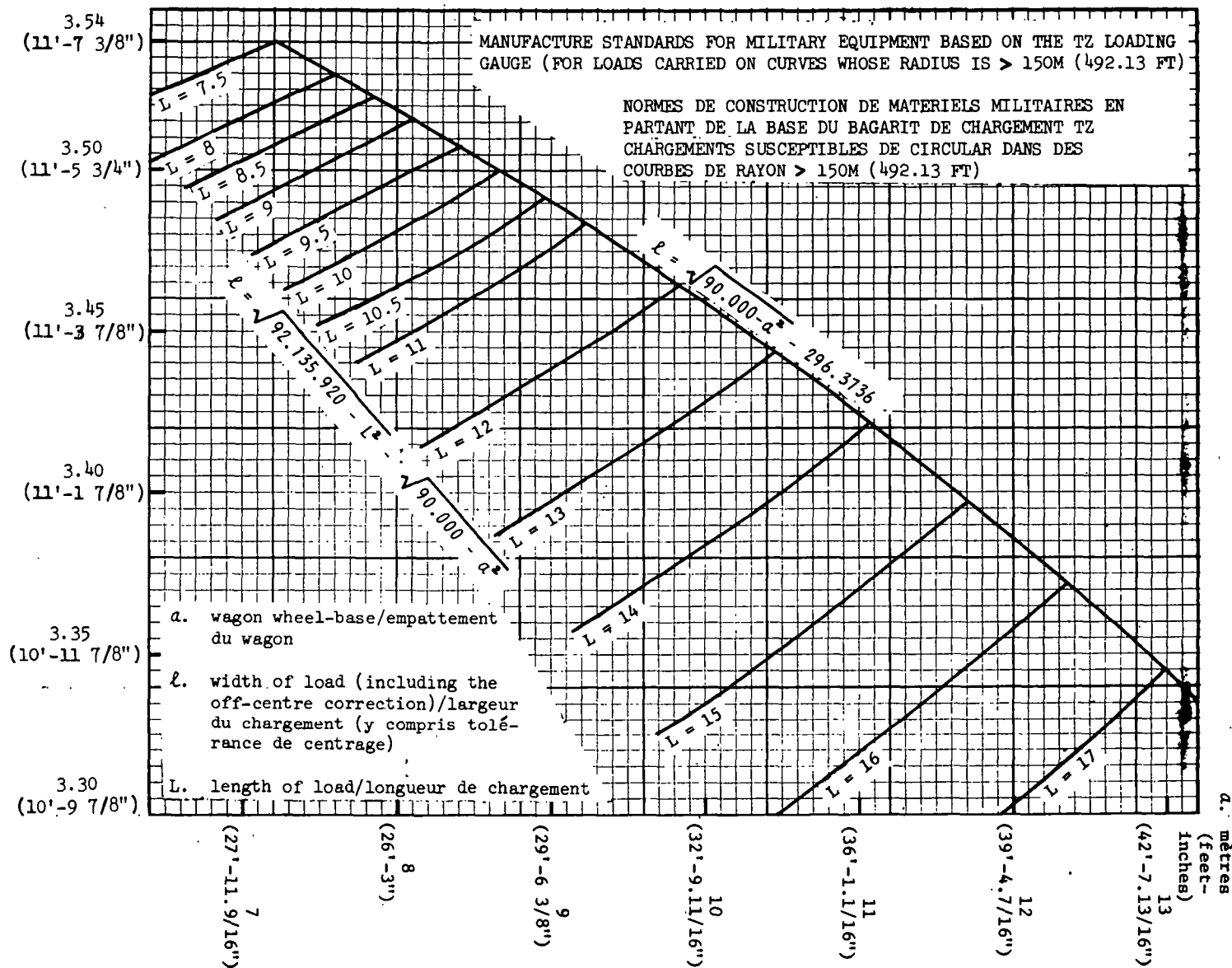


Figure N-8.

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